Supplementary material

Karol Opara[a,1], Jarosław Arabas[b]

[a]*Systems Research Institute, Polish Academy of Sciences*
[b]*Institute of Computer Science, Warsaw University of Technology, Poland*

Abstract

This is supplementary material to the article "Comparison of Mutation Strategies in Differential Evolution – a Probabilistic Perspective". It provides more detailed benchmark results than those reported in the paper. The design of the experiment, which serves also as the "table of contents", is provided in Table 1.

Keywords: DE, benchmark, CEC 2017, scaling factor, differential mutation

1. Description of results

This document contains detailed results of the analysis of several differential mutation operators for the CEC 2013 benchmark. The results were aggregated three times. Table 1 contains a synthetic summary of the whole benchmark. Each row references a more detailed table with results split among different mutation operators. Each row of these detailed tables is a summary of benchmark results presented in the linked tables.

Table 2 contains another summary of the whole dataset, aggregated over parameter settings and search space dimensionality. It provides information about the extent of equivalence for particular differential mutation operators.

Table 30 provides results for DE/cur/1 (BBDE). This operator is treated separately as it does not use crossover, i.e. $C_\mathrm{r} = 1$, and has a randomized value of the scaling factor from a log-normal distribution with fixed parameters.

[1]Corresponding author: e-mail karol.opara@ibspan.waw.pl, tel. +48 22 3810 393

Table 1: Synthetic results of the simulations using CEC'13 benchmark depending on the search space dimension n, scaling factor F and crossover ratio C_r

Setting			Overall results $+/\cdot/-$			Details
n	F	C_r	DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
10	0.5	0.1	102/114/8	28/168/28	61/163/0	Table 3
10	0.5	0.3	110/106/8	32/155/37	76/147/1	Table 4
10	0.5	0.5	108/99/17	31/144/49	72/147/5	Table 5
10	0.5	0.7	118/81/25	25/126/73	71/137/16	Table 6
10	0.5	0.9	86/83/55	100/95/29	63/134/27	Table 7
10	0.5	1	129/75/20	150/59/15	51/128/45	Table 8
10	0.3	0.9	44/82/98	65/104/55	27/127/70	Table 9
10	0.5	0.9	86/83/55	100/95/29	63/134/27	Table 7
10	0.7	0.9	32/81/111	77/95/52	90/121/13	Table 10
10	0.9	0.9	17/86/121	126/83/15	135/80/9	Table 11
30	0.5	0.1	89/108/27	59/114/51	84/135/5	Table 12
30	0.5	0.3	83/104/37	69/107/48	74/129/21	Table 13
30	0.5	0.5	84/94/46	65/102/57	70/127/27	Table 14
30	0.5	0.7	81/85/58	53/92/79	61/128/35	Table 15
30	0.5	0.9	99/62/63	25/66/133	58/118/48	Table 16
30	0.5	1	125/58/41	150/49/25	55/122/47	Table 17
30	0.3	0.9	88/84/52	22/80/122	23/102/99	Table 18
30	0.5	0.9	99/62/63	25/66/133	58/118/48	Table 16
30	0.7	0.9	38/96/90	26/44/154	131/90/3	Table 19
30	0.9	0.9	65/95/64	25/46/153	140/84/0	Table 20
50	0.5	0.1	90/101/33	76/110/38	82/124/18	Table 21
50	0.5	0.3	84/101/39	87/100/37	66/121/37	Table 22
50	0.5	0.5	81/90/53	79/92/53	67/119/38	Table 23
50	0.5	0.7	72/86/66	63/78/83	59/118/47	Table 24
50	0.5	0.9	85/64/75	28/80/116	89/83/52	Table 25
50	0.5	1	122/66/36	152/48/24	73/90/61	Table 26
50	0.3	0.9	104/63/57	31/93/100	43/91/90	Table 27
50	0.5	0.9	85/64/75	28/80/116	89/83/52	Table 25
50	0.7	0.9	36/97/91	27/76/121	151/72/1	Table 28
50	0.9	0.9	61/111/52	17/74/133	133/91/0	Table 29
Summary			2503/2581/1636	1841/2721/2158	2315/3463/942	

Table 2: Synthetic results of the simulations: sums of the numbers of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for various parameter setting in 10, 30 and 50-dimensional CEC'13 benchmarks

No of test results $+/\cdot/-$		Modelling DE variant		
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin
Modelled variant	DE/rand/1/bin	0/755/1	277/225/254	353/308/95
	DE/rand/2/bin	17/356/383	186/232/338	188/523/45
	DE/best/1/bin	501/154/101	2/754/0	212/433/111
	DE/best/2/bin	374/145/237	122/392/242	152/579/25
	DE/cur-to-rand/1/bin	374/202/180	231/189/336	210/332/214
	DE/cur-to-best/1/bin	492/167/97	298/278/180	285/359/112
	DE/cur-to-$p$best/1/bin	362/215/179	314/205/237	441/190/125
	DE/cur/1	79/5/0	84/0/0	74/10/0
	DE/either-or/bin	113/378/265	258/205/293	264/404/88
Summary		2312/2377/1443	1722/2480/1880	2179/3138/815

Table 3: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.1}$ in $n = \mathbf{10}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	4/18/6	6/22/0	Table 39
	DE/rand/2/bin	1/25/2	0/18/10	5/23/0	Table 40
	DE/best/1/bin	16/11/1	0/28/0	7/21/0	Table 41
	DE/best/2/bin	23/5/0	1/25/2	4/24/0	Table 42
	DE/cur-to-rand/1/bin	21/7/0	5/19/4	13/15/0	Table 43
	DE/cur-to-best/1/bin	23/4/1	9/18/1	11/17/0	Table 44
	DE/cur-to-$p$best/1/bin	17/10/1	6/22/0	9/19/0	Table 46
	DE/either-or/bin	1/24/3	3/20/5	6/22/0	Table 45
Summary $(+/\cdot/-)$		102/114/8	28/168/28	61/163/0	

Table 4: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.3}$ in $n = \mathbf{10}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	2/20/6	10/18/0	Table 47
	DE/rand/2/bin	1/23/4	0/17/11	6/22/0	Table 48
	DE/best/1/bin	23/4/1	0/28/0	9/19/0	Table 49
	DE/best/2/bin	19/8/1	3/22/3	7/21/0	Table 50
	DE/cur-to-rand/1/bin	21/7/0	7/13/8	8/19/1	Table 51
	DE/cur-to-best/1/bin	23/5/0	9/18/1	13/15/0	Table 52
	DE/cur-to-$p$best/1/bin	22/6/0	9/18/1	14/14/0	Table 54
	DE/either-or/bin	1/25/2	2/19/7	9/19/0	Table 53
Summary $(+/\cdot/-)$		110/106/8	32/155/37	76/147/1	

Table 5: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.5}$ in $n = \mathbf{10}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	5/18/5	10/18/0	Table 55
	DE/rand/2/bin	0/19/9	1/11/16	6/22/0	Table 56
	DE/best/1/bin	21/7/0	0/28/0	6/22/0	Table 57
	DE/best/2/bin	23/5/0	2/22/4	9/19/0	Table 58
	DE/cur-to-rand/1/bin	20/6/2	4/14/10	3/20/5	Table 59
	DE/cur-to-best/1/bin	23/5/0	5/21/2	10/18/0	Table 60
	DE/cur-to-$p$best/1/bin	21/5/2	9/16/3	18/10/0	Table 62
	DE/either-or/bin	0/24/4	5/14/9	10/18/0	Table 61
Summary $(+/\cdot/-)$		108/99/17	31/144/49	72/147/5	

Table 6: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.7}$ in $n = \mathbf{10}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	3/15/10	10/17/1	Table 63
	DE/rand/2/bin	0/17/11	0/12/16	7/19/2	Table 64
	DE/best/1/bin	22/4/2	0/28/0	6/20/2	Table 65
	DE/best/2/bin	26/2/0	0/17/11	8/20/0	Table 66
	DE/cur-to-rand/1/bin	26/0/2	3/13/12	3/17/8	Table 67
	DE/cur-to-best/1/bin	22/5/1	7/17/4	9/18/1	Table 68
	DE/cur-to-$p$best/1/bin	22/4/2	11/12/5	18/9/1	Table 70
	DE/either-or/bin	0/21/7	1/12/15	10/17/1	Table 69
Summary $(+/\cdot/-)$		118/81/25	25/126/73	71/137/16	

Table 7: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.9}$ in $n = \mathbf{10}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	20/7/1	16/12/0	Table 71
	DE/rand/2/bin	1/5/22	20/4/4	6/18/4	Table 72
	DE/best/1/bin	8/12/8	0/28/0	0/22/6	Table 73
	DE/best/2/bin	27/1/0	9/19/0	6/22/0	Table 74
	DE/cur-to-rand/1/bin	26/1/1	12/6/10	5/15/8	Table 75
	DE/cur-to-best/1/bin	14/10/4	14/11/3	9/16/3	Table 76
	DE/cur-to-$p$best/1/bin	10/12/6	14/9/5	12/10/6	Table 78
	DE/either-or/bin	0/14/14	11/11/6	9/19/0	Table 77
Summary $(+/\cdot/-)$		86/83/55	100/95/29	63/134/27	

Table 8: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{1}$ in $n = \mathbf{10}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	23/5/0	5/14/9	Table 79
	DE/rand/2/bin	9/13/6	28/0/0	5/22/1	Table 80
	DE/best/1/bin	6/10/12	0/28/0	0/12/16	Table 81
	DE/best/2/bin	28/0/0	21/7/0	9/17/2	Table 82
	DE/cur-to-rand/1/bin	28/0/0	19/2/7	8/16/4	Table 83
	DE/cur-to-best/1/bin	15/11/2	18/10/0	4/21/3	Table 84
	DE/cur-to-$p$best/1/bin	27/1/0	17/3/8	10/8/10	Table 86
	DE/either-or/bin	16/12/0	24/4/0	10/18/0	Table 85
Summary $(+/\cdot/-)$		129/75/20	150/59/15	51/128/45	

Table 9: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.3}$ and $C_\mathrm{r} = \mathbf{0.9}$ in $n = \mathbf{10}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	17/7/4	10/10/8	Table 31
	DE/rand/2/bin	0/16/12	11/11/6	7/21/0	Table 32
	DE/best/1/bin	3/5/20	0/28/0	0/25/3	Table 33
	DE/best/2/bin	7/9/12	3/25/0	0/27/1	Table 34
	DE/cur-to-rand/1/bin	2/7/19	5/7/16	1/6/21	Table 35
	DE/cur-to-best/1/bin	8/7/13	5/12/11	0/12/16	Table 36
	DE/cur-to-$p$best/1/bin	5/7/16	9/7/12	2/14/12	Table 38
	DE/either-or/bin	19/3/6	15/7/6	7/12/9	Table 37
Summary $(+/\cdot/-)$		44/82/98	65/104/55	27/127/70	

Table 10: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.7}$ and $C_\mathrm{r} = \mathbf{0.9}$ in $n = \mathbf{10}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	15/11/2	20/8/0	Table 87
	DE/rand/2/bin	0/2/26	16/6/6	5/20/3	Table 88
	DE/best/1/bin	13/7/8	0/28/0	7/15/6	Table 89
	DE/best/2/bin	0/7/21	6/7/15	13/15/0	Table 90
	DE/cur-to-rand/1/bin	0/14/14	9/11/8	6/22/0	Table 91
	DE/cur-to-best/1/bin	12/7/9	10/14/4	11/17/0	Table 92
	DE/cur-to-$p$best/1/bin	5/12/11	12/11/5	21/7/0	Table 94
	DE/either-or/bin	2/4/22	9/7/12	7/17/4	Table 93
Summary $(+/\cdot/-)$		32/81/111	77/95/52	90/121/13	

Table 11: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.9}$ and $C_\mathrm{r} = \mathbf{0.9}$ in $n = \mathbf{10}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/27/1	26/2/0	25/3/0	Table 95
	DE/rand/2/bin	1/2/25	13/11/4	4/23/1	Table 96
	DE/best/1/bin	1/8/19	0/28/0	12/11/5	Table 97
	DE/best/2/bin	1/1/26	16/10/2	13/15/0	Table 98
	DE/cur-to-rand/1/bin	2/14/12	17/7/4	19/9/0	Table 99
	DE/cur-to-best/1/bin	3/16/9	18/10/0	20/8/0	Table 100
	DE/cur-to-$p$best/1/bin	8/16/4	16/9/3	26/2/0	Table 102
	DE/either-or/bin	1/2/25	20/6/2	16/9/3	Table 101
Summary $(+/\cdot/-)$		17/86/121	126/83/15	135/80/9	

Table 12: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.1}$ in $n = \mathbf{30}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	7/11/10	7/20/1	Table 111
	DE/rand/2/bin	1/22/5	4/14/10	8/20/0	Table 112
	DE/best/1/bin	24/4/0	1/27/0	9/19/0	Table 113
	DE/best/2/bin	12/8/8	1/22/5	6/22/0	Table 114
	DE/cur-to-rand/1/bin	15/7/6	8/11/9	12/13/3	Table 115
	DE/cur-to-best/1/bin	22/6/0	13/12/3	14/14/0	Table 116
	DE/cur-to-$p$best/1/bin	14/9/5	17/7/4	20/8/0	Table 118
	DE/either-or/bin	1/24/3	8/10/10	8/19/1	Table 117
Summary $(+/\cdot/-)$		89/108/27	59/114/51	84/135/5	

Table 13: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.3}$ in $n = \mathbf{30}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	10/12/6	9/14/5	Table 119
	DE/rand/2/bin	0/22/6	9/10/9	4/21/3	Table 120
	DE/best/1/bin	25/3/0	0/28/0	9/19/0	Table 121
	DE/best/2/bin	9/7/12	0/21/7	4/24/0	Table 122
	DE/cur-to-rand/1/bin	12/8/8	11/9/8	8/12/8	Table 123
	DE/cur-to-best/1/bin	22/5/1	14/9/5	15/12/1	Table 124
	DE/cur-to-$p$best/1/bin	12/11/5	14/10/4	17/11/0	Table 126
	DE/either-or/bin	3/20/5	11/8/9	8/16/4	Table 125
Summary $(+/\cdot/-)$		83/104/37	69/107/48	74/129/21	

Table 14: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.5}$ in $n = \mathbf{30}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	11/10/7	9/15/4	Table 127
	DE/rand/2/bin	0/18/10	8/9/11	5/20/3	Table 128
	DE/best/1/bin	25/3/0	0/28/0	9/19/0	Table 129
	DE/best/2/bin	9/6/13	0/18/10	5/23/0	Table 130
	DE/cur-to-rand/1/bin	13/7/8	10/9/9	4/13/11	Table 131
	DE/cur-to-best/1/bin	23/3/2	10/11/7	9/16/3	Table 132
	DE/cur-to-$p$best/1/bin	11/11/6	15/7/6	21/5/2	Table 134
	DE/either-or/bin	3/18/7	11/10/7	8/16/4	Table 133
Summary $(+/\cdot/-)$		84/94/46	65/102/57	70/127/27	

Table 15: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.7}$ in $n = \mathbf{30}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	12/6/10	9/15/4	Table 135
	DE/rand/2/bin	0/11/17	0/10/18	1/24/3	Table 136
	DE/best/1/bin	24/4/0	0/28/0	7/16/5	Table 137
	DE/best/2/bin	12/4/12	0/16/12	7/21/0	Table 138
	DE/cur-to-rand/1/bin	15/5/8	10/7/11	3/15/10	Table 139
	DE/cur-to-best/1/bin	23/3/2	7/14/7	9/14/5	Table 140
	DE/cur-to-$p$best/1/bin	6/11/11	12/6/10	20/3/5	Table 142
	DE/either-or/bin	1/19/8	12/5/11	5/20/3	Table 141
Summary $(+/\cdot/-)$		81/85/58	53/92/79	61/128/35	

Table 16: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.9}$ in $n = \mathbf{30}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	4/5/19	20/7/1	Table 143
	DE/rand/2/bin	0/8/20	0/3/25	6/21/1	Table 144
	DE/best/1/bin	26/2/0	0/28/0	4/18/6	Table 145
	DE/best/2/bin	21/5/2	4/9/15	4/24/0	Table 146
	DE/cur-to-rand/1/bin	22/3/3	5/3/20	0/14/14	Table 147
	DE/cur-to-best/1/bin	23/3/2	5/7/16	6/12/10	Table 148
	DE/cur-to-$p$best/1/bin	6/6/16	3/6/19	13/6/9	Table 150
	DE/either-or/bin	1/7/20	4/5/19	5/16/7	Table 149
Summary $(+/\cdot/-)$		99/62/63	25/66/133	58/118/48	

Table 17: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{1}$ in $n = \mathbf{30}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	25/1/2	12/12/4	Table 151
	DE/rand/2/bin	3/5/20	25/3/0	19/9/0	Table 152
	DE/best/1/bin	10/7/11	0/28/0	0/14/14	Table 153
	DE/best/2/bin	28/0/0	26/2/0	0/21/7	Table 154
	DE/cur-to-rand/1/bin	28/0/0	17/1/10	9/17/2	Table 155
	DE/cur-to-best/1/bin	17/7/4	17/11/0	0/26/2	Table 156
	DE/cur-to-$p$best/1/bin	23/1/4	15/2/11	8/5/15	Table 158
	DE/either-or/bin	16/10/2	25/1/2	7/18/3	Table 157
Summary $(+/\cdot/-)$		125/58/41	150/49/25	55/122/47	

Table 18: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.3}$ and $C_\mathrm{r} = \mathbf{0.9}$ in $n = \mathbf{30}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	7/6/15	6/10/12	Table 103
	DE/rand/2/bin	0/12/16	6/6/16	5/18/5	Table 104
	DE/best/1/bin	16/11/1	0/28/0	1/21/6	Table 105
	DE/best/2/bin	25/3/0	3/24/1	0/26/2	Table 106
	DE/cur-to-rand/1/bin	7/6/15	0/2/26	1/2/25	Table 107
	DE/cur-to-best/1/bin	18/9/1	0/5/23	1/7/20	Table 108
	DE/cur-to-$p$best/1/bin	7/9/12	0/4/24	4/6/18	Table 110
	DE/either-or/bin	15/6/7	6/5/17	5/12/11	Table 109
Summary $(+/\cdot/-)$		88/84/52	22/80/122	23/102/99	

Table 19: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.7}$ and $C_\mathrm{r} = \mathbf{0.9}$ in $n = \mathbf{30}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	0/1/27	22/6/0	Table 159
	DE/rand/2/bin	0/7/21	0/1/27	7/21/0	Table 160
	DE/best/1/bin	14/10/4	0/28/0	15/11/2	Table 161
	DE/best/2/bin	1/6/21	0/2/26	11/17/0	Table 162
	DE/cur-to-rand/1/bin	1/17/10	2/4/22	15/12/1	Table 163
	DE/cur-to-best/1/bin	8/9/11	11/5/12	22/6/0	Table 164
	DE/cur-to-$p$best/1/bin	14/10/4	13/2/13	21/7/0	Table 166
	DE/either-or/bin	0/9/19	0/1/27	18/10/0	Table 165
Summary $(+/\cdot/-)$		38/96/90	26/44/154	131/90/3	

Table 20: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.9}$ and $C_\mathrm{r} = \mathbf{0.9}$ in $n = \mathbf{30}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	0/3/25	21/7/0	Table 167
	DE/rand/2/bin	0/9/19	0/2/26	2/26/0	Table 168
	DE/best/1/bin	23/4/1	0/28/0	27/1/0	Table 169
	DE/best/2/bin	1/9/18	0/2/26	5/23/0	Table 170
	DE/cur-to-rand/1/bin	3/23/2	0/2/26	19/9/0	Table 171
	DE/cur-to-best/1/bin	17/9/2	13/7/8	25/3/0	Table 172
	DE/cur-to-$p$best/1/bin	21/5/2	12/1/15	24/4/0	Table 174
	DE/either-or/bin	0/8/20	0/1/27	17/11/0	Table 173
Summary $(+/\cdot/-)$		65/95/64	25/46/153	140/84/0	

Table 21: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.1}$ in $n = \mathbf{50}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	9/11/8	9/13/6	Table 183
	DE/rand/2/bin	0/23/5	6/13/9	6/20/2	Table 184
	DE/best/1/bin	25/3/0	0/28/0	7/21/0	Table 185
	DE/best/2/bin	11/7/10	0/25/3	6/22/0	Table 186
	DE/cur-to-rand/1/bin	13/6/9	14/8/6	11/11/6	Table 187
	DE/cur-to-best/1/bin	23/4/1	18/8/2	14/13/1	Table 188
	DE/cur-to-$p$best/1/bin	16/8/4	19/6/3	21/7/0	Table 190
	DE/either-or/bin	2/22/4	10/11/7	8/17/3	Table 189
Summary $(+/\cdot/-)$		90/101/33	76/110/38	82/124/18	

Table 22: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.3}$ in $n = \mathbf{50}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	12/10/6	7/10/11	Table 191
	DE/rand/2/bin	0/21/7	10/11/7	4/20/4	Table 192
	DE/best/1/bin	24/4/0	0/28/0	9/19/0	Table 193
	DE/best/2/bin	8/8/12	0/24/4	0/28/0	Table 194
	DE/cur-to-rand/1/bin	12/6/10	16/5/7	4/12/12	Table 195
	DE/cur-to-best/1/bin	23/4/1	17/6/5	15/11/2	Table 196
	DE/cur-to-$p$best/1/bin	12/12/4	19/7/2	22/6/0	Table 198
	DE/either-or/bin	5/18/5	13/9/6	5/15/8	Table 197
Summary $(+/\cdot/-)$		84/101/39	87/100/37	66/121/37	

Table 23: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.5}$ in $n = \mathbf{50}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	13/9/6	8/12/8	Table 199
	DE/rand/2/bin	0/15/13	6/16/6	3/21/4	Table 200
	DE/best/1/bin	26/2/0	0/28/0	11/17/0	Table 201
	DE/best/2/bin	5/8/15	0/15/13	3/25/0	Table 202
	DE/cur-to-rand/1/bin	13/6/9	15/4/9	3/12/13	Table 203
	DE/cur-to-best/1/bin	23/3/2	13/8/7	13/12/3	Table 204
	DE/cur-to-$p$best/1/bin	10/9/9	18/4/6	22/4/2	Table 206
	DE/either-or/bin	4/19/5	14/8/6	4/16/8	Table 205
Summary $(+/\cdot/-)$		81/90/53	79/92/53	67/119/38	

Table 24: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.7}$ in $n = \mathbf{50}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	12/7/9	12/10/6	Table 207
	DE/rand/2/bin	0/12/16	0/12/16	5/22/1	Table 208
	DE/best/1/bin	25/3/0	0/28/0	5/17/6	Table 209
	DE/best/2/bin	6/6/16	0/9/19	4/24/0	Table 210
	DE/cur-to-rand/1/bin	13/9/6	12/8/8	3/10/15	Table 211
	DE/cur-to-best/1/bin	22/4/2	11/6/11	4/16/8	Table 212
	DE/cur-to-$p$best/1/bin	5/9/14	15/2/11	21/2/5	Table 214
	DE/either-or/bin	1/15/12	13/6/9	5/17/6	Table 213
Summary $(+/\cdot/-)$		72/86/66	63/78/83	59/118/47	

Table 25: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.9}$ in $n = \mathbf{50}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	1/11/16	21/7/0	Table 215
	DE/rand/2/bin	0/8/20	0/5/23	17/10/1	Table 216
	DE/best/1/bin	25/2/1	0/28/0	4/17/7	Table 217
	DE/best/2/bin	16/7/5	1/9/18	12/16/0	Table 218
	DE/cur-to-rand/1/bin	20/1/7	11/4/13	1/9/18	Table 219
	DE/cur-to-best/1/bin	22/3/3	5/8/15	3/12/13	Table 220
	DE/cur-to-$p$best/1/bin	2/6/20	6/7/15	18/2/8	Table 222
	DE/either-or/bin	0/9/19	4/8/16	13/10/5	Table 221
Summary $(+/\cdot/-)$		85/64/75	28/80/116	89/83/52	

Table 26: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{1}$ in $n = \mathbf{50}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	25/2/1	14/7/7	Table 223
	DE/rand/2/bin	0/7/21	21/7/0	19/9/0	Table 224
	DE/best/1/bin	18/6/4	1/27/0	0/6/22	Table 225
	DE/best/2/bin	28/0/0	26/2/0	0/16/12	Table 226
	DE/cur-to-rand/1/bin	28/0/0	17/2/9	11/14/3	Table 227
	DE/cur-to-best/1/bin	19/6/3	24/4/0	2/25/1	Table 228
	DE/cur-to-$p$best/1/bin	19/5/4	13/3/12	8/5/15	Table 230
	DE/either-or/bin	10/14/4	25/1/2	19/8/1	Table 229
Summary $(+/\cdot/-)$		122/66/36	152/48/24	73/90/61	

Table 27: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.3}$ and $C_\mathrm{r} = \mathbf{0.9}$ in $n = \mathbf{50}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	14/5/9	12/8/8	Table 175
	DE/rand/2/bin	0/7/21	2/12/14	10/11/7	Table 176
	DE/best/1/bin	26/1/1	0/28/0	4/19/5	Table 177
	DE/best/2/bin	25/2/1	0/28/0	1/26/1	Table 178
	DE/cur-to-rand/1/bin	9/5/14	1/3/24	1/2/25	Table 179
	DE/cur-to-best/1/bin	21/6/1	1/7/20	0/8/20	Table 180
	DE/cur-to-$p$best/1/bin	12/5/11	1/4/23	6/5/17	Table 182
	DE/either-or/bin	11/9/8	12/6/10	9/12/7	Table 181
Summary $(+/\cdot/-)$		104/63/57	31/93/100	43/91/90	

Table 28: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.7}$ and $C_\mathrm{r} = \mathbf{0.9}$ in $n = \mathbf{50}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	0/7/21	21/7/0	Table 231
	DE/rand/2/bin	0/14/14	0/5/23	14/14/0	Table 232
	DE/best/1/bin	13/9/6	0/28/0	21/7/0	Table 233
	DE/best/2/bin	1/7/20	0/6/22	13/15/0	Table 234
	DE/cur-to-rand/1/bin	2/13/13	1/9/18	19/8/1	Table 235
	DE/cur-to-best/1/bin	6/6/16	13/7/8	22/6/0	Table 236
	DE/cur-to-$p$best/1/bin	14/10/4	13/8/7	23/5/0	Table 238
	DE/either-or/bin	0/10/18	0/6/22	18/10/0	Table 237
Summary $(+/\cdot/-)$		36/97/91	27/76/121	151/72/1	

Table 29: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for $F = \mathbf{0.9}$ and $C_\mathrm{r} = \mathbf{0.9}$ in $n = \mathbf{50}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		Modelling DE variant			Details
		DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled variant	DE/rand/1/bin	0/28/0	0/5/23	22/6/0	Table 239
	DE/rand/2/bin	0/13/15	0/3/25	2/26/0	Table 240
	DE/best/1/bin	19/8/1	0/28/0	23/5/0	Table 241
	DE/best/2/bin	2/14/12	0/4/24	2/26/0	Table 242
	DE/cur-to-rand/1/bin	2/24/2	0/6/22	20/8/0	Table 243
	DE/cur-to-best/1/bin	17/7/4	11/12/5	24/4/0	Table 244
	DE/cur-to-$p$best/1/bin	21/5/2	6/12/10	22/6/0	Table 246
	DE/either-or/bin	0/12/16	0/4/24	18/10/0	Table 245
Summary $(+/\cdot/-)$		61/111/52	17/74/133	133/91/0	

Table 30: Number of test problems for which the mutation operator described in each row gives: better / not significantly different / worse results than modelling with DE/rand/1/bin, DE/best/1/bin and Gaussian mutation with equivalent scaling factors for default values of F (randomized) and $C_\mathrm{r} = \mathbf{1}$ in $n \in \{\mathbf{10}, \mathbf{30}, \mathbf{50}\}$-dimensional CEC'13 benchmark

No of test results $+/\cdot/-$		n	Modelling DE variant			Details
			DE/rand/1/bin	DE/best/1/bin	DE/X/∞/bin	
Modelled	DE/cur/1	10	28/0/0	28/0/0	25/3/0	Table 247
	DE/cur/1	30	26/2/0	28/0/0	24/4/0	Table 248
	DE/cur/1	50	25/3/0	28/0/0	25/3/0	Table 249
Summary $(+/\cdot/-)$			79/5/0	84/0/0	74/10/0	

Table 31: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	1.0e+05	1.0e+05	·	0.0e+00	−	0.0e+00	−
	(1.7e+05)	(1.3e+05)		(0.0e+00)		(0.0e+00)	
f_3	1.7e+06	1.0e+06	·	1.5e−01	−	4.1e−01	−
	(7.3e+06)	(3.2e+06)		(9.0e−01)		(1.3e+00)	
f_4	1.6e+03	1.5e+03	·	0.0e+00	−	4.6e−01	−
	(1.4e+03)	(1.3e+03)		(0.0e+00)		(2.5e+00)	
f_5	3.3e−01	2.6e−01	·	0.0e+00	·	0.0e+00	·
	(1.8e+00)	(1.8e+00)		(0.0e+00)		(0.0e+00)	
f_6	6.6e+00	6.1e+00	·	3.6e+00	−	6.5e+00	·
	(4.2e+00)	(4.4e+00)		(4.7e+00)		(4.0e+00)	
f_7	1.8e−01	5.7e−02	·	8.7e+00	+	7.0e−06	−
	(6.2e−01)	(9.3e−02)		(1.3e+01)		(1.5e−05)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(7.8e−02)	(7.7e−02)		(9.7e−02)		(8.2e−02)	
f_9	1.1e+00	1.2e+00	·	2.5e+00	·	3.0e−01	−
	(8.2e−01)	(8.5e−01)		(1.8e+00)		(5.1e−01)	
f_{10}	7.6e−02	6.2e−02	·	2.8e−01	+	4.3e−01	+
	(7.2e−02)	(5.6e−02)		(2.1e−01)		(7.5e−02)	
f_{11}	5.9e−01	6.9e−01	·	1.2e+01	+	1.7e+01	+
	(6.6e−01)	(8.5e−01)		(5.3e+00)		(2.7e+00)	
f_{12}	6.0e+00	5.6e+00	·	2.2e+01	+	2.2e+01	+
	(2.7e+00)	(3.1e+00)		(8.6e+00)		(3.5e+00)	
f_{13}	7.7e+00	9.1e+00	·	3.5e+01	+	2.1e+01	+
	(4.5e+00)	(5.2e+00)		(1.3e+01)		(3.3e+00)	
f_{14}	1.6e+01	1.9e+01	·	4.0e+02	+	1.1e+03	+
	(1.1e+01)	(1.5e+01)		(2.0e+02)		(1.3e+02)	
f_{15}	8.3e+02	8.0e+02	·	1.3e+03	+	1.3e+03	+
	(3.4e+02)	(3.2e+02)		(3.8e+02)		(1.6e+02)	
f_{16}	1.2e+00	1.2e+00	·	1.6e+00	·	1.1e+00	·
	(2.6e−01)	(2.6e−01)		(5.0e−01)		(1.9e−01)	
f_{17}	1.1e+01	1.2e+01	·	2.2e+01	+	2.8e+01	+
	(2.2e+00)	(7.5e−01)		(6.9e+00)		(2.6e+00)	
f_{18}	3.0e+01	2.7e+01	·	4.7e+01	+	3.2e+01	·
	(4.9e+00)	(5.0e+00)		(9.0e+00)		(2.9e+00)	
f_{19}	5.4e−01	5.9e−01	·	1.2e+00	+	1.7e+00	+
	(1.8e−01)	(1.5e−01)		(3.8e−01)		(3.2e−01)	
f_{20}	2.1e+00	2.2e+00	·	3.4e+00	+	2.3e+00	·
	(5.6e−01)	(4.7e−01)		(4.8e−01)		(1.9e−01)	
f_{21}	3.8e+02	3.9e+02	·	3.7e+02	·	4.0e+02	·
	(7.0e+01)	(5.7e+01)		(7.2e+01)		(0.0e+00)	
f_{22}	5.6e+01	5.5e+01	·	4.9e+02	+	1.1e+03	+
	(4.5e+01)	(3.8e+01)		(2.3e+02)		(1.9e+02)	
f_{23}	3.7e+02	4.4e+02	·	1.4e+03	+	1.1e+03	+
	(2.7e+02)	(3.4e+02)		(4.0e+02)		(1.4e+02)	
f_{24}	1.9e+02	2.0e+02	·	2.1e+02	+	2.0e+02	−
	(2.8e+01)	(2.4e+01)		(5.2e+00)		(3.3e−10)	
f_{25}	2.0e+02	2.0e+02	·	2.1e+02	+	2.0e+02	−
	(1.9e+01)	(1.3e+01)		(1.4e+01)		(8.4e−07)	
f_{26}	1.4e+02	1.4e+02	·	1.8e+02	·	1.4e+02	·
	(4.4e+01)	(4.3e+01)		(5.6e+01)		(3.1e+01)	
f_{27}	3.2e+02	3.1e+02	·	3.9e+02	+	3.0e+02	−
	(5.9e+01)	(4.5e+01)		(9.9e+01)		(0.0e+00)	
f_{28}	2.6e+02	2.8e+02	·	2.9e+02	·	3.0e+02	·
	(8.5e+01)	(6.0e+01)		(7.6e+01)		(1.4e−13)	
Summary (+/·/−)		0/28/0		17/7/4		10/10/8	

Table 32: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	5.4e−01	1.4e+01	·	0.0e+00	·	0.0e+00	·
	(3.0e+00)	(6.9e+01)		(0.0e+00)		(0.0e+00)	
f_3	5.1e−01	7.0e−01	·	7.1e−02	−	1.6e−01	·
	(9.8e−01)	(1.4e+00)		(4.1e−01)		(1.6e−01)	
f_4	1.1e−01	2.4e+00	·	0.0e+00	·	0.0e+00	·
	(4.3e−01)	(1.1e+01)		(0.0e+00)		(0.0e+00)	
f_5	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_6	3.8e+00	5.2e+00	·	3.3e+00	·	2.9e+00	·
	(4.3e+00)	(4.5e+00)		(4.6e+00)		(3.9e+00)	
f_7	2.4e−05	2.2e−05	·	5.3e+00	+	3.9e−04	+
	(2.9e−05)	(6.7e−05)		(6.4e+00)		(2.7e−04)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(6.7e−02)	(9.0e−02)		(1.1e−01)		(7.8e−02)	
f_9	8.4e−01	6.9e−01	·	3.1e+00	+	3.3e+00	·
	(1.2e+00)	(7.7e−01)		(2.1e+00)		(3.6e+00)	
f_{10}	3.4e−01	3.6e−02	−	3.3e−01	·	4.6e−01	+
	(1.1e−01)	(2.9e−02)		(2.3e−01)		(6.7e−02)	
f_{11}	1.8e+01	9.3e−01	−	1.1e+01	−	2.0e+01	·
	(4.0e+00)	(1.1e+00)		(5.0e+00)		(2.9e+00)	
f_{12}	2.5e+01	7.3e+00	−	2.0e+01	·	2.4e+01	·
	(4.5e+00)	(4.1e+00)		(9.5e+00)		(3.3e+00)	
f_{13}	2.3e+01	8.0e+00	−	3.2e+01	+	2.3e+01	·
	(3.4e+00)	(4.8e+00)		(1.2e+01)		(4.1e+00)	
f_{14}	9.7e+02	2.5e+01	−	4.6e+02	−	1.1e+03	+
	(1.3e+02)	(2.2e+01)		(2.0e+02)		(1.5e+02)	
f_{15}	1.3e+03	9.2e+02	−	1.4e+03	·	1.4e+03	·
	(1.4e+02)	(3.5e+02)		(3.1e+02)		(1.6e+02)	
f_{16}	1.1e+00	1.3e+00	·	1.7e+00	+	1.1e+00	·
	(1.8e−01)	(2.9e−01)		(4.5e−01)		(2.0e−01)	
f_{17}	2.9e+01	1.2e+01	−	2.4e+01	−	3.0e+01	·
	(2.8e+00)	(8.4e−01)		(6.5e+00)		(3.5e+00)	
f_{18}	3.4e+01	3.0e+01	−	4.7e+01	+	3.5e+01	·
	(3.8e+00)	(6.0e+00)		(1.1e+01)		(3.7e+00)	
f_{19}	1.9e+00	6.1e−01	−	1.2e+00	−	1.9e+00	·
	(3.1e−01)	(1.9e−01)		(5.2e−01)		(3.2e−01)	
f_{20}	2.4e+00	2.1e+00	−	3.5e+00	+	2.5e+00	·
	(2.6e−01)	(3.3e−01)		(4.3e−01)		(2.0e−01)	
f_{21}	3.7e+02	3.8e+02	·	3.6e+02	·	4.0e+02	·
	(7.9e+01)	(5.4e+01)		(8.0e+01)		(0.0e+00)	
f_{22}	9.8e+02	6.8e+01	−	4.2e+02	−	1.2e+03	+
	(2.2e+02)	(3.9e+01)		(2.0e+02)		(1.7e+02)	
f_{23}	1.2e+03	6.6e+02	−	1.5e+03	+	1.3e+03	·
	(1.9e+02)	(3.1e+02)		(3.0e+02)		(1.8e+02)	
f_{24}	2.0e+02	2.0e+02	·	2.1e+02	+	2.0e+02	·
	(2.0e+01)	(2.3e+01)		(1.4e+01)		(1.6e+00)	
f_{25}	2.0e+02	2.0e+02	·	2.1e+02	+	2.0e+02	+
	(1.0e+01)	(1.6e+01)		(5.3e+00)		(4.0e−04)	
f_{26}	1.5e+02	1.4e+02	·	1.8e+02	·	1.4e+02	·
	(3.6e+01)	(4.4e+01)		(6.8e+01)		(2.9e+01)	
f_{27}	3.1e+02	3.2e+02	·	3.7e+02	+	3.0e+02	+
	(3.7e+01)	(6.1e+01)		(9.6e+01)		(2.1e−05)	
f_{28}	2.8e+02	2.8e+02	·	2.9e+02	·	3.0e+02	+
	(6.0e+01)	(6.5e+01)		(7.5e+01)		(1.6e−13)	
Summary (+/·/−)		0/16/12		11/11/6		7/21/0	

Table 33: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	6.8e+02	1.7e+01	−	6.3e+02	·	6.0e+02	·
	(5.0e+02)	(1.5e+01)		(4.7e+02)		(4.8e+02)	
f_2	6.1e+06	1.8e+06	−	5.6e+06	·	3.6e+06	·
	(6.5e+06)	(1.6e+06)		(4.5e+06)		(3.5e+06)	
f_3	4.0e+09	9.9e+07	−	5.5e+09	·	4.4e+09	·
	(4.3e+09)	(1.4e+08)		(5.7e+09)		(4.8e+09)	
f_4	5.5e+03	1.2e+04	+	4.5e+03	·	4.1e+03	·
	(5.2e+03)	(4.4e+03)		(4.1e+03)		(4.8e+03)	
f_5	2.8e+02	7.6e+00	−	2.9e+02	·	3.9e+02	·
	(2.8e+02)	(7.4e+00)		(2.1e+02)		(3.2e+02)	
f_6	8.6e+01	1.2e+01	−	9.0e+01	·	9.3e+01	·
	(6.0e+01)	(5.2e+00)		(5.2e+01)		(6.3e+01)	
f_7	9.1e+01	1.7e+01	−	9.5e+01	·	8.7e+01	·
	(3.5e+01)	(9.5e+00)		(3.8e+01)		(3.9e+01)	
f_8	2.1e+01	2.0e+01	−	2.1e+01	·	2.0e+01	−
	(8.9e−02)	(8.1e−02)		(1.1e−01)		(6.6e−02)	
f_9	6.4e+00	5.5e+00	·	6.6e+00	·	6.0e+00	·
	(1.5e+00)	(1.3e+00)		(1.4e+00)		(1.5e+00)	
f_{10}	9.6e+01	7.5e+00	−	1.2e+02	·	9.6e+01	·
	(7.4e+01)	(8.7e+00)		(1.0e+02)		(8.5e+01)	
f_{11}	4.3e+01	7.8e+00	−	4.1e+01	·	4.1e+01	·
	(1.7e+01)	(2.8e+00)		(1.6e+01)		(1.7e+01)	
f_{12}	4.4e+01	3.9e+01	·	5.0e+01	·	3.9e+01	·
	(1.6e+01)	(1.1e+01)		(2.2e+01)		(1.5e+01)	
f_{13}	6.8e+01	3.8e+01	−	7.3e+01	·	6.8e+01	·
	(2.5e+01)	(1.2e+01)		(2.6e+01)		(2.6e+01)	
f_{14}	7.2e+02	7.8e+01	−	7.4e+02	·	6.6e+02	·
	(2.5e+02)	(3.2e+01)		(2.3e+02)		(2.0e+02)	
f_{15}	1.0e+03	1.4e+03	+	1.1e+03	·	7.9e+02	−
	(2.4e+02)	(1.7e+02)		(2.8e+02)		(2.9e+02)	
f_{16}	9.7e−01	1.3e+00	+	1.0e+00	·	1.1e+00	·
	(4.8e−01)	(2.2e−01)		(4.7e−01)		(2.1e−01)	
f_{17}	6.2e+01	2.3e+01	−	6.1e+01	·	5.2e+01	·
	(2.3e+01)	(4.7e+00)		(2.5e+01)		(1.9e+01)	
f_{18}	6.7e+01	5.7e+01	·	7.0e+01	·	5.6e+01	·
	(2.6e+01)	(1.1e+01)		(2.7e+01)		(1.7e+01)	
f_{19}	4.1e+01	1.7e+00	−	2.3e+01	·	3.3e+01	·
	(1.6e+02)	(6.2e−01)		(3.7e+01)		(1.0e+02)	
f_{20}	3.8e+00	3.7e+00	·	3.7e+00	·	3.4e+00	·
	(4.2e−01)	(2.8e−01)		(4.0e−01)		(5.1e−01)	
f_{21}	4.4e+02	3.7e+02	−	4.5e+02	·	4.3e+02	·
	(5.3e+01)	(5.9e+01)		(4.8e+01)		(5.6e+01)	
f_{22}	9.2e+02	1.8e+02	−	9.2e+02	·	9.9e+02	·
	(3.9e+02)	(6.9e+01)		(3.3e+02)		(3.0e+02)	
f_{23}	1.4e+03	1.7e+03	·	1.4e+03	·	1.1e+03	−
	(3.9e+02)	(2.2e+02)		(3.3e+02)		(3.2e+02)	
f_{24}	2.2e+02	2.1e+02	−	2.2e+02	·	2.2e+02	·
	(5.1e+00)	(1.7e+01)		(5.0e+00)		(3.8e+00)	
f_{25}	2.2e+02	2.0e+02	−	2.2e+02	·	2.2e+02	·
	(1.0e+01)	(2.4e+01)		(1.4e+01)		(1.4e+01)	
f_{26}	2.2e+02	1.8e+02	−	2.2e+02	·	2.2e+02	·
	(6.5e+01)	(3.0e+01)		(6.4e+01)		(6.5e+01)	
f_{27}	6.1e+02	4.2e+02	−	5.9e+02	·	5.9e+02	·
	(5.6e+01)	(4.3e+01)		(6.2e+01)		(6.2e+01)	
f_{28}	7.5e+02	3.3e+02	−	7.4e+02	·	7.3e+02	·
	(1.4e+02)	(1.3e+02)		(1.6e+02)		(1.5e+02)	
Summary (+/·/−)		3/5/20		0/28/0		0/25/3	

Table 34: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.1e+01	8.6e+00	·	1.3e+01	·	1.6e+01	·
	(2.6e+01)	(9.2e+00)		(2.9e+01)		(2.9e+01)	
f_2	3.3e+05	1.4e+06	+	4.0e+05	·	1.8e+05	·
	(1.1e+06)	(2.0e+06)		(8.5e+05)		(2.8e+05)	
f_3	1.3e+08	4.1e+07	·	2.6e+08	·	9.1e+07	·
	(3.0e+08)	(3.8e+07)		(6.1e+08)		(2.2e+08)	
f_4	3.0e+01	9.0e+03	+	9.7e+01	·	1.3e+01	·
	(7.8e+01)	(5.4e+03)		(2.0e+02)		(3.1e+01)	
f_5	7.5e+01	4.3e+00	−	7.5e+01	·	7.2e+01	·
	(6.3e+01)	(2.3e+00)		(7.5e+01)		(5.6e+01)	
f_6	4.7e+01	9.7e+00	−	4.3e+01	·	4.0e+01	·
	(3.2e+01)	(3.0e+00)		(3.6e+01)		(3.2e+01)	
f_7	4.7e+01	1.3e+01	−	6.0e+01	·	4.3e+01	·
	(2.7e+01)	(7.8e+00)		(3.7e+01)		(3.1e+01)	
f_8	2.0e+01	2.0e+01	+	2.1e+01	+	2.0e+01	·
	(6.7e−02)	(7.7e−02)		(1.1e−01)		(7.7e−02)	
f_9	4.4e+00	5.0e+00	·	4.9e+00	·	3.8e+00	·
	(1.3e+00)	(1.5e+00)		(1.4e+00)		(1.3e+00)	
f_{10}	1.9e+01	4.3e+00	−	3.3e+01	·	1.7e+01	·
	(2.1e+01)	(3.6e+00)		(4.0e+01)		(2.1e+01)	
f_{11}	2.4e+01	6.7e+00	−	2.6e+01	·	2.4e+01	·
	(1.0e+01)	(1.8e+00)		(1.1e+01)		(1.2e+01)	
f_{12}	2.4e+01	2.9e+01	·	2.7e+01	·	2.7e+01	·
	(1.1e+01)	(1.1e+01)		(9.6e+00)		(1.3e+01)	
f_{13}	4.2e+01	3.4e+01	·	4.7e+01	·	4.1e+01	·
	(1.5e+01)	(1.1e+01)		(1.7e+01)		(1.6e+01)	
f_{14}	4.8e+02	9.5e+01	−	5.7e+02	+	4.4e+02	·
	(1.5e+02)	(4.5e+01)		(1.7e+02)		(1.9e+02)	
f_{15}	7.4e+02	1.4e+03	+	9.6e+02	+	5.8e+02	−
	(2.8e+02)	(2.1e+02)		(3.2e+02)		(2.2e+02)	
f_{16}	1.1e+00	1.3e+00	+	1.3e+00	·	1.2e+00	·
	(2.3e−01)	(2.2e−01)		(4.7e−01)		(2.1e−01)	
f_{17}	3.0e+01	2.1e+01	−	3.4e+01	·	2.7e+01	·
	(1.1e+01)	(4.2e+00)		(1.2e+01)		(7.6e+00)	
f_{18}	3.3e+01	4.9e+01	+	3.8e+01	·	3.9e+01	·
	(1.0e+01)	(1.0e+01)		(1.3e+01)		(8.9e+00)	
f_{19}	1.4e+00	1.4e+00	·	1.5e+00	·	1.4e+00	·
	(5.6e−01)	(4.7e−01)		(1.0e+00)		(8.4e−01)	
f_{20}	3.4e+00	3.5e+00	·	3.5e+00	·	3.3e+00	·
	(5.3e−01)	(3.1e−01)		(4.8e−01)		(5.5e−01)	
f_{21}	3.6e+02	3.5e+02	·	3.8e+02	·	3.8e+02	·
	(8.5e+01)	(8.8e+01)		(5.7e+01)		(6.4e+01)	
f_{22}	6.6e+02	1.7e+02	−	8.1e+02	·	6.2e+02	·
	(3.1e+02)	(6.6e+01)		(3.1e+02)		(2.4e+02)	
f_{23}	8.9e+02	1.5e+03	+	1.2e+03	·	8.5e+02	·
	(3.3e+02)	(2.7e+02)		(3.8e+02)		(3.0e+02)	
f_{24}	2.2e+02	2.1e+02	−	2.2e+02	·	2.2e+02	·
	(1.4e+01)	(3.4e+00)		(1.4e+01)		(1.4e+01)	
f_{25}	2.1e+02	2.0e+02	−	2.1e+02	·	2.1e+02	·
	(2.2e+01)	(2.1e+01)		(2.1e+01)		(2.5e+01)	
f_{26}	2.5e+02	1.8e+02	−	2.4e+02	·	2.4e+02	·
	(7.2e+01)	(3.1e+01)		(7.4e+01)		(7.3e+01)	
f_{27}	5.2e+02	3.9e+02	−	5.2e+02	·	5.1e+02	·
	(8.4e+01)	(3.6e+01)		(8.2e+01)		(8.9e+01)	
f_{28}	4.7e+02	3.2e+02	·	5.2e+02	·	5.0e+02	·
	(2.1e+02)	(9.7e+01)		(2.3e+02)		(2.1e+02)	
Summary (+/·/−)		7/9/12		3/25/0		0/27/1	

Table 35: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.9e+03	6.7e−02	−	0.0e+00	−	2.5e+02	−
	(8.1e+02)	(1.1e−01)		(0.0e+00)		(2.3e+02)	
f_2	4.4e+06	1.5e+05	−	1.3e+01	−	2.3e+06	−
	(1.3e+06)	(1.3e+05)		(8.1e+01)		(1.2e+06)	
f_3	9.7e+08	3.2e+05	−	1.1e+00	−	1.2e+09	·
	(8.2e+08)	(4.5e+05)		(4.8e+00)		(6.9e+08)	
f_4	6.9e+03	2.4e+03	−	0.0e+00	−	5.0e+03	−
	(2.1e+03)	(2.4e+03)		(0.0e+00)		(1.8e+03)	
f_5	4.8e+02	1.5e−01	−	0.0e+00	−	1.9e+02	−
	(1.8e+02)	(2.9e−01)		(0.0e+00)		(1.3e+02)	
f_6	1.2e+02	7.3e+00	−	5.5e+00	−	6.0e+01	−
	(3.1e+01)	(4.0e+00)		(4.7e+00)		(2.2e+01)	
f_7	2.3e+01	2.0e+00	−	1.4e+01	−	1.0e+01	−
	(1.2e+01)	(1.8e+00)		(1.9e+01)		(5.5e+00)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(7.7e−02)	(8.5e−02)		(1.0e−01)		(8.7e−02)	
f_9	3.4e+00	1.8e+00	−	2.9e+00	·	2.3e+00	−
	(1.0e+00)	(9.8e−01)		(1.5e+00)		(7.5e−01)	
f_{10}	2.0e+02	6.3e−01	−	2.0e−01	−	3.3e+01	−
	(7.0e+01)	(2.5e−01)		(1.7e−01)		(2.4e+01)	
f_{11}	3.9e+01	2.9e+00	−	1.4e+01	−	7.8e+00	−
	(8.8e+00)	(1.3e+00)		(6.7e+00)		(3.3e+00)	
f_{12}	4.1e+01	2.0e+01	−	1.8e+01	−	1.1e+01	−
	(7.8e+00)	(9.6e+00)		(7.0e+00)		(5.9e+00)	
f_{13}	4.4e+01	2.4e+01	−	3.4e+01	·	1.9e+01	−
	(1.2e+01)	(8.7e+00)		(1.4e+01)		(8.9e+00)	
f_{14}	1.1e+03	6.3e+01	−	4.7e+02	−	8.9e+02	−
	(1.4e+02)	(4.3e+01)		(2.2e+02)		(1.9e+02)	
f_{15}	1.0e+03	1.2e+03	+	1.1e+03	·	8.9e+02	·
	(1.3e+02)	(2.7e+02)		(3.3e+02)		(1.5e+02)	
f_{16}	1.2e+00	1.3e+00	·	1.5e+00	+	1.2e+00	·
	(2.0e−01)	(2.4e−01)		(4.3e−01)		(2.3e−01)	
f_{17}	4.4e+01	1.5e+01	−	2.2e+01	−	2.4e+01	−
	(8.4e+00)	(1.9e+00)		(7.0e+00)		(2.4e+00)	
f_{18}	4.5e+01	4.7e+01	·	4.1e+01	·	2.9e+01	−
	(7.5e+00)	(9.4e+00)		(1.1e+01)		(3.2e+00)	
f_{19}	9.7e+01	7.3e−01	−	1.1e+00	−	3.1e+00	−
	(1.2e+02)	(2.6e−01)		(4.4e−01)		(2.5e+00)	
f_{20}	3.2e+00	3.1e+00	·	3.4e+00	·	2.7e+00	−
	(2.3e−01)	(3.9e−01)		(4.8e−01)		(5.2e−01)	
f_{21}	4.3e+02	3.8e+02	−	3.6e+02	−	4.0e+02	−
	(1.5e+01)	(5.4e+01)		(7.7e+01)		(2.6e+00)	
f_{22}	1.3e+03	1.2e+02	−	5.1e+02	−	1.8e+02	−
	(2.3e+02)	(6.3e+01)		(2.1e+02)		(1.6e+02)	
f_{23}	1.2e+03	1.1e+03	·	1.1e+03	·	6.3e+02	−
	(2.3e+02)	(2.8e+02)		(4.0e+02)		(2.8e+02)	
f_{24}	1.5e+02	2.0e+02	+	2.1e+02	+	2.1e+02	+
	(1.7e+01)	(2.6e+01)		(1.9e+01)		(3.4e+00)	
f_{25}	2.0e+02	2.0e+02	·	2.1e+02	+	2.0e+02	·
	(1.3e+01)	(1.1e+01)		(2.0e+01)		(2.1e+00)	
f_{26}	1.2e+02	1.5e+02	·	2.1e+02	+	1.2e+02	−
	(7.8e+00)	(3.9e+01)		(7.8e+01)		(3.7e+01)	
f_{27}	4.2e+02	3.2e+02	−	4.3e+02	·	3.7e+02	−
	(1.8e+01)	(2.8e+01)		(9.5e+01)		(3.9e+01)	
f_{28}	5.5e+02	2.8e+02	−	3.1e+02	−	5.7e+02	·
	(1.3e+02)	(6.1e+01)		(6.6e+01)		(7.9e+01)	
Summary (+/·/−)		2/7/19		5/7/16		1/6/21	

Table 36: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	5.0e+01	4.5e−01	−	0.0e+00	−	0.0e+00	−
	(8.1e+01)	(6.1e−01)		(0.0e+00)		(0.0e+00)	
f_2	1.6e+06	2.9e+05	−	4.1e+02	−	1.6e+03	−
	(1.6e+06)	(3.4e+05)		(7.2e+02)		(4.0e+03)	
f_3	6.6e+08	2.1e+06	−	6.3e−02	−	1.3e+03	−
	(7.7e+08)	(3.3e+06)		(4.3e−01)		(6.4e+03)	
f_4	1.3e+03	3.1e+03	+	9.8e−06	−	1.1e−03	−
	(1.1e+03)	(3.0e+03)		(5.3e−05)		(6.0e−03)	
f_5	7.0e+01	6.5e−01	−	1.9e−01	−	4.4e+00	−
	(5.6e+01)	(7.1e−01)		(8.1e−01)		(1.6e+01)	
f_6	4.3e+01	7.9e+00	−	7.6e+00	−	9.9e+00	−
	(3.1e+01)	(3.7e+00)		(8.3e+00)		(1.3e+01)	
f_7	1.9e+01	4.3e+00	−	2.8e+01	·	6.8e+00	−
	(1.7e+01)	(3.5e+00)		(2.9e+01)		(8.6e+00)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(7.0e−02)	(7.7e−02)		(9.6e−02)		(6.7e−02)	
f_9	2.8e+00	2.7e+00	·	3.3e+00	·	2.3e+00	·
	(9.2e−01)	(1.1e+00)		(1.6e+00)		(1.4e+00)	
f_{10}	1.8e+01	1.0e+00	−	2.6e−01	−	3.0e−01	−
	(2.0e+01)	(4.6e−01)		(3.3e−01)		(1.2e+00)	
f_{11}	1.2e+01	4.1e+00	−	1.3e+01	·	7.6e+00	−
	(4.6e+00)	(1.6e+00)		(6.5e+00)		(3.8e+00)	
f_{12}	1.4e+01	2.5e+01	+	2.1e+01	+	9.6e+00	−
	(5.1e+00)	(9.5e+00)		(9.0e+00)		(5.5e+00)	
f_{13}	2.1e+01	3.0e+01	+	3.4e+01	+	1.5e+01	−
	(8.2e+00)	(8.8e+00)		(1.4e+01)		(8.5e+00)	
f_{14}	9.6e+02	7.0e+01	−	4.9e+02	−	6.3e+02	−
	(2.8e+02)	(3.4e+01)		(1.8e+02)		(4.0e+02)	
f_{15}	9.7e+02	1.3e+03	+	1.1e+03	·	1.1e+03	·
	(2.2e+02)	(2.0e+02)		(3.6e+02)		(3.0e+02)	
f_{16}	1.1e+00	1.4e+00	+	1.5e+00	+	1.2e+00	·
	(1.9e−01)	(2.6e−01)		(4.6e−01)		(1.7e−01)	
f_{17}	2.9e+01	1.6e+01	−	2.0e+01	−	2.7e+01	·
	(4.4e+00)	(2.1e+00)		(5.4e+00)		(4.8e+00)	
f_{18}	3.4e+01	5.0e+01	+	3.9e+01	·	3.3e+01	·
	(4.7e+00)	(9.5e+00)		(1.1e+01)		(5.0e+00)	
f_{19}	1.6e+00	8.8e−01	−	1.0e+00	·	1.0e+00	·
	(1.3e+00)	(2.3e−01)		(3.9e−01)		(3.1e−01)	
f_{20}	2.6e+00	3.2e+00	+	3.5e+00	+	2.7e+00	·
	(5.6e−01)	(3.3e−01)		(4.1e−01)		(6.5e−01)	
f_{21}	4.0e+02	3.8e+02	·	3.9e+02	−	3.9e+02	−
	(1.8e+00)	(6.9e+01)		(4.1e+01)		(4.8e+01)	
f_{22}	8.0e+02	1.3e+02	−	5.6e+02	·	3.8e+02	−
	(3.2e+02)	(5.8e+01)		(2.7e+02)		(3.5e+02)	
f_{23}	1.0e+03	1.3e+03	+	1.2e+03	·	7.3e+02	·
	(4.1e+02)	(2.8e+02)		(4.4e+02)		(5.5e+02)	
f_{24}	2.1e+02	2.1e+02	·	2.1e+02	·	2.1e+02	·
	(1.7e+01)	(1.4e+01)		(1.3e+01)		(1.6e+01)	
f_{25}	2.0e+02	2.0e+02	·	2.0e+02	·	2.0e+02	−
	(2.4e+01)	(1.5e+01)		(2.2e+01)		(2.2e+01)	
f_{26}	1.6e+02	1.7e+02	·	2.1e+02	·	1.9e+02	·
	(5.2e+01)	(3.7e+01)		(7.2e+01)		(7.0e+01)	
f_{27}	3.8e+02	3.3e+02	·	4.3e+02	·	3.5e+02	·
	(6.8e+01)	(1.1e+01)		(9.8e+01)		(8.6e+01)	
f_{28}	4.7e+02	2.8e+02	−	3.7e+02	−	3.5e+02	−
	(1.5e+02)	(7.2e+01)		(1.6e+02)		(1.2e+02)	
Summary (+/·/−)		8/7/13		5/12/11		0/12/16	

Table 37: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	6.0e−02	4.8e+00	+	0.0e+00	·	0.0e+00	·
	(4.3e−01)	(1.2e+01)		(0.0e+00)		(0.0e+00)	
f_2	2.1e+05	1.8e+06	+	0.0e+00	−	3.4e+03	−
	(3.2e+05)	(1.9e+06)		(0.0e+00)		(1.0e+04)	
f_3	2.7e+07	7.2e+08	+	1.2e−01	−	6.8e+04	−
	(5.5e+07)	(1.1e+09)		(8.8e−01)		(3.2e+05)	
f_4	1.7e+03	5.6e+03	+	0.0e+00	−	6.9e+01	−
	(1.3e+03)	(3.0e+03)		(0.0e+00)		(1.3e+02)	
f_5	4.8e+00	3.6e+01	+	0.0e+00	−	1.0e−01	−
	(1.6e+01)	(6.6e+01)		(0.0e+00)		(6.4e−01)	
f_6	7.4e+00	2.1e+01	+	4.7e+00	−	6.3e+00	·
	(4.2e+00)	(2.4e+01)		(4.9e+00)		(3.9e+00)	
f_7	4.3e−01	1.6e+01	+	8.7e+00	+	2.7e−04	−
	(1.1e+00)	(1.0e+01)		(1.5e+01)		(1.8e−03)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(7.7e−02)	(8.1e−02)		(9.8e−02)		(7.1e−02)	
f_9	1.0e+00	2.2e+00	+	2.3e+00	+	2.8e−01	−
	(8.4e−01)	(9.5e−01)		(1.6e+00)		(5.2e−01)	
f_{10}	6.5e−02	1.0e+01	+	3.0e−01	+	2.4e−01	·
	(1.1e−01)	(1.5e+01)		(1.9e−01)		(1.9e−01)	
f_{11}	7.8e−01	1.9e+00	+	1.2e+01	+	1.6e+01	+
	(9.8e−01)	(1.5e+00)		(5.4e+00)		(2.2e+00)	
f_{12}	4.4e+00	9.1e+00	+	2.2e+01	+	2.0e+01	+
	(3.7e+00)	(3.9e+00)		(1.2e+01)		(2.8e+00)	
f_{13}	6.1e+00	1.3e+01	+	3.3e+01	+	2.0e+01	+
	(3.8e+00)	(7.0e+00)		(1.2e+01)		(3.1e+00)	
f_{14}	5.7e+02	1.3e+01	−	4.8e+02	·	9.8e+02	+
	(1.4e+02)	(1.5e+01)		(2.1e+02)		(1.7e+02)	
f_{15}	1.1e+03	3.9e+02	−	1.3e+03	·	1.2e+03	·
	(1.9e+02)	(2.6e+02)		(3.5e+02)		(1.4e+02)	
f_{16}	1.1e+00	1.2e+00	·	1.6e+00	+	1.1e+00	·
	(1.9e−01)	(3.1e−01)		(4.1e−01)		(2.2e−01)	
f_{17}	2.5e+01	1.2e+01	−	2.4e+01	·	2.5e+01	·
	(2.5e+00)	(1.8e+00)		(6.7e+00)		(3.1e+00)	
f_{18}	2.9e+01	2.4e+01	−	4.3e+01	+	3.0e+01	·
	(3.0e+00)	(5.8e+00)		(1.1e+01)		(2.6e+00)	
f_{19}	1.4e+00	6.3e−01	−	1.2e+00	−	1.7e+00	+
	(2.4e−01)	(2.5e−01)		(4.8e−01)		(2.6e−01)	
f_{20}	2.2e+00	2.7e+00	+	3.4e+00	+	2.3e+00	·
	(3.6e−01)	(6.9e−01)		(4.8e−01)		(3.5e−01)	
f_{21}	4.0e+02	3.8e+02	+	3.7e+02	·	4.0e+02	·
	(4.8e−04)	(5.7e+01)		(7.4e+01)		(0.0e+00)	
f_{22}	2.5e+02	5.6e+01	−	4.9e+02	+	8.5e+02	+
	(2.4e+02)	(3.9e+01)		(2.3e+02)		(2.3e+02)	
f_{23}	4.8e+02	3.8e+02	·	1.3e+03	+	9.6e+02	+
	(3.5e+02)	(2.1e+02)		(3.5e+02)		(2.1e+02)	
f_{24}	2.0e+02	2.1e+02	+	2.1e+02	+	2.0e+02	−
	(1.7e+01)	(1.9e+01)		(1.0e+01)		(1.4e−06)	
f_{25}	2.0e+02	2.1e+02	+	2.1e+02	+	2.0e+02	−
	(4.4e+00)	(1.4e+01)		(6.1e+00)		(5.0e−05)	
f_{26}	1.4e+02	1.6e+02	+	1.8e+02	·	1.3e+02	·
	(4.4e+01)	(4.3e+01)		(6.3e+01)		(2.8e+01)	
f_{27}	3.0e+02	3.7e+02	+	3.7e+02	+	3.0e+02	−
	(2.0e+01)	(5.8e+01)		(9.2e+01)		(1.7e−03)	
f_{28}	3.0e+02	3.8e+02	+	3.1e+02	·	3.0e+02	·
	(7.4e+00)	(1.3e+02)		(3.8e+01)		(3.2e−14)	
Summary (+/·/−)		19/3/6		15/7/6		7/12/9	

Table 38: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.7e+02	9.2e−02	−	0.0e+00	−	0.0e+00	−
	(1.8e+02)	(2.7e−01)		(0.0e+00)		(0.0e+00)	
f_2	2.1e+06	1.4e+05	−	2.5e+01	−	1.1e+02	−
	(1.7e+06)	(1.1e+05)		(1.1e+02)		(7.9e+02)	
f_3	8.8e+08	3.1e+05	−	1.8e−03	−	4.6e−01	−
	(8.6e+08)	(4.0e+05)		(1.0e−02)		(1.6e+00)	
f_4	2.1e+03	2.0e+03	·	0.0e+00	−	0.0e+00	−
	(1.5e+03)	(1.6e+03)		(0.0e+00)		(0.0e+00)	
f_5	1.7e+02	1.6e−01	−	0.0e+00	−	5.8e−04	−
	(1.5e+02)	(4.0e−01)		(0.0e+00)		(3.8e−03)	
f_6	5.8e+01	7.5e+00	−	5.3e+00	−	5.4e+00	−
	(2.6e+01)	(3.8e+00)		(4.7e+00)		(4.7e+00)	
f_7	1.1e+01	1.9e+00	−	1.8e+01	·	3.6e+00	−
	(1.1e+01)	(1.8e+00)		(2.3e+01)		(1.0e+01)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(7.1e−02)	(6.9e−02)		(1.1e−01)		(6.5e−02)	
f_9	2.1e+00	1.7e+00	·	2.7e+00	·	1.9e+00	·
	(8.1e−01)	(1.1e+00)		(1.6e+00)		(1.1e+00)	
f_{10}	4.4e+01	6.8e−01	−	1.8e−01	−	1.2e−01	−
	(4.2e+01)	(2.8e−01)		(1.3e−01)		(1.1e−01)	
f_{11}	1.2e+01	2.8e+00	−	1.3e+01	·	9.1e+00	·
	(6.3e+00)	(1.5e+00)		(5.9e+00)		(6.5e+00)	
f_{12}	1.4e+01	1.8e+01	·	1.9e+01	+	1.8e+01	·
	(6.2e+00)	(9.9e+00)		(9.5e+00)		(8.5e+00)	
f_{13}	1.8e+01	2.4e+01	+	3.1e+01	+	1.5e+01	·
	(9.4e+00)	(9.0e+00)		(1.1e+01)		(8.2e+00)	
f_{14}	9.5e+02	5.8e+01	−	4.1e+02	−	8.6e+02	·
	(1.6e+02)	(3.1e+01)		(1.9e+02)		(2.9e+02)	
f_{15}	9.1e+02	1.2e+03	+	1.2e+03	+	1.2e+03	+
	(1.7e+02)	(2.6e+02)		(3.5e+02)		(2.2e+02)	
f_{16}	1.1e+00	1.3e+00	·	1.5e+00	+	1.1e+00	·
	(2.0e−01)	(2.6e−01)		(4.0e−01)		(2.0e−01)	
f_{17}	2.8e+01	1.5e+01	−	2.0e+01	−	2.9e+01	·
	(4.0e+00)	(1.6e+00)		(6.1e+00)		(3.9e+00)	
f_{18}	3.2e+01	4.6e+01	+	4.0e+01	+	3.4e+01	·
	(4.2e+00)	(1.1e+01)		(9.5e+00)		(5.3e+00)	
f_{19}	1.9e+00	7.6e−01	−	1.1e+00	−	1.5e+00	·
	(1.8e+00)	(2.2e−01)		(4.7e−01)		(3.6e−01)	
f_{20}	2.8e+00	3.0e+00	·	3.3e+00	+	2.6e+00	·
	(5.5e−01)	(4.0e−01)		(5.3e−01)		(7.3e−01)	
f_{21}	4.0e+02	3.7e+02	−	3.6e+02	−	3.9e+02	−
	(1.9e+01)	(8.4e+01)		(8.3e+01)		(4.9e+01)	
f_{22}	6.8e+02	1.2e+02	−	5.4e+02	·	5.5e+02	·
	(2.7e+02)	(5.6e+01)		(2.6e+02)		(3.6e+02)	
f_{23}	8.2e+02	1.2e+03	+	1.2e+03	+	1.1e+03	+
	(3.1e+02)	(2.8e+02)		(4.2e+02)		(4.1e+02)	
f_{24}	2.1e+02	2.0e+02	−	2.1e+02	·	2.0e+02	−
	(2.2e+01)	(2.8e+01)		(2.2e+01)		(2.2e+01)	
f_{25}	2.1e+02	2.0e+02	·	2.1e+02	·	2.0e+02	·
	(4.6e+00)	(2.4e+01)		(1.4e+01)		(1.4e+01)	
f_{26}	1.3e+02	1.5e+02	+	1.9e+02	+	1.9e+02	·
	(3.9e+01)	(3.8e+01)		(7.5e+01)		(7.3e+01)	
f_{27}	3.7e+02	3.2e+02	−	4.3e+02	·	3.4e+02	−
	(3.8e+01)	(2.5e+01)		(1.0e+02)		(8.2e+01)	
f_{28}	5.1e+02	2.5e+02	−	3.0e+02	−	3.0e+02	−
	(1.4e+02)	(9.4e+01)		(8.1e+01)		(8.3e+01)	
Summary (+/·/−)		5/7/16		9/7/12		2/14/12	

Table 39: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	3.0e+06	2.7e+06	·	2.1e+06	·	2.7e+06	·
	(1.4e+06)	(1.1e+06)		(1.0e+06)		(1.3e+06)	
f_3	5.2e+07	5.5e+07	·	2.7e+07	−	5.3e+07	·
	(2.9e+07)	(3.5e+07)		(1.8e+07)		(2.7e+07)	
f_4	1.2e+04	1.2e+04	·	1.1e+04	·	1.2e+04	·
	(3.6e+03)	(3.3e+03)		(2.8e+03)		(3.6e+03)	
f_5	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_6	7.5e+00	6.4e+00	·	2.8e+00	−	6.4e+00	·
	(2.2e+00)	(2.6e+00)		(2.6e+00)		(3.1e+00)	
f_7	2.8e+01	2.7e+01	·	2.0e+01	−	2.9e+01	·
	(7.2e+00)	(6.2e+00)		(5.3e+00)		(7.0e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(7.2e−02)	(6.6e−02)		(7.3e−02)		(6.7e−02)	
f_9	5.6e+00	5.8e+00	·	5.7e+00	·	5.9e+00	·
	(6.8e−01)	(6.9e−01)		(6.8e−01)		(5.9e−01)	
f_{10}	3.5e+00	3.3e+00	·	3.4e+00	·	3.3e+00	·
	(1.3e+00)	(9.8e−01)		(1.1e+00)		(1.1e+00)	
f_{11}	0.0e+00	0.0e+00	·	0.0e+00	·	6.1e−06	+
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(1.1e−05)	
f_{12}	2.2e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.3e+00)	(3.6e+00)		(4.7e+00)		(3.9e+00)	
f_{13}	2.3e+01	2.6e+01	·	2.4e+01	·	2.6e+01	·
	(6.0e+00)	(5.5e+00)		(4.2e+00)		(5.0e+00)	
f_{14}	2.1e−02	8.6e−03	·	9.4e−01	+	2.2e+01	+
	(3.2e−02)	(2.2e−02)		(2.0e+00)		(5.9e+00)	
f_{15}	1.1e+03	1.1e+03	·	1.0e+03	·	1.0e+03	·
	(1.6e+02)	(1.5e+02)		(1.9e+02)		(1.9e+02)	
f_{16}	1.1e+00	1.1e+00	·	1.1e+00	·	1.0e+00	·
	(2.0e−01)	(2.2e−01)		(1.7e−01)		(2.3e−01)	
f_{17}	1.0e+01	1.0e+01	·	1.0e+01	+	1.1e+01	+
	(2.4e−12)	(5.5e−01)		(7.0e−02)		(3.4e−01)	
f_{18}	3.8e+01	3.9e+01	·	4.1e+01	+	3.8e+01	·
	(4.0e+00)	(4.3e+00)		(4.6e+00)		(4.4e+00)	
f_{19}	3.5e−01	3.2e−01	·	5.1e−01	+	4.0e−01	·
	(1.1e−01)	(1.2e−01)		(1.4e−01)		(8.7e−02)	
f_{20}	3.4e+00	3.3e+00	·	3.2e+00	·	3.4e+00	·
	(2.7e−01)	(2.3e−01)		(2.5e−01)		(2.0e−01)	
f_{21}	2.7e+02	2.8e+02	·	2.3e+02	·	3.4e+02	+
	(6.4e+01)	(5.9e+01)		(9.8e+01)		(5.3e+01)	
f_{22}	4.6e+01	4.9e+01	·	4.3e+01	·	9.7e+01	+
	(1.6e+01)	(1.2e+01)		(4.0e+01)		(2.3e+01)	
f_{23}	1.2e+03	1.3e+03	·	1.2e+03	·	1.3e+03	·
	(1.8e+02)	(1.5e+02)		(1.9e+02)		(1.5e+02)	
f_{24}	1.5e+02	1.5e+02	·	1.4e+02	−	1.5e+02	·
	(9.3e+00)	(1.2e+01)		(1.7e+01)		(1.0e+01)	
f_{25}	2.0e+02	1.9e+02	·	1.9e+02	·	1.9e+02	·
	(1.9e+01)	(1.9e+01)		(2.6e+01)		(1.8e+01)	
f_{26}	1.4e+02	1.4e+02	·	1.3e+02	−	1.4e+02	·
	(7.4e+00)	(7.9e+00)		(7.0e+00)		(5.7e+00)	
f_{27}	4.1e+02	4.0e+02	·	4.0e+02	·	4.0e+02	·
	(1.5e+01)	(1.9e+01)		(1.8e+01)		(1.6e+01)	
f_{28}	2.8e+02	2.9e+02	·	2.3e+02	−	3.3e+02	+
	(3.4e+01)	(2.6e+01)		(9.1e+01)		(2.2e+01)	
Summary (+/·/−)		0/28/0		4/18/6		6/22/0	

Table 40: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	2.9e+06	2.6e+06	·	2.5e+06	·	2.7e+06	·
	(1.2e+06)	(1.3e+06)		(1.1e+06)		(1.1e+06)	
f_3	8.2e+07	7.5e+07	·	4.4e+07	−	8.9e+07	·
	(4.7e+07)	(5.0e+07)		(2.6e+07)		(4.2e+07)	
f_4	1.2e+04	1.3e+04	·	1.1e+04	·	1.3e+04	·
	(4.0e+03)	(3.9e+03)		(2.6e+03)		(4.7e+03)	
f_5	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_6	5.7e+00	6.2e+00	·	2.2e+00	−	5.9e+00	·
	(2.5e+00)	(2.7e+00)		(2.0e+00)		(2.8e+00)	
f_7	2.9e+01	3.0e+01	·	2.2e+01	−	3.0e+01	·
	(6.3e+00)	(6.5e+00)		(6.3e+00)		(7.4e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(8.4e−02)	(7.7e−02)		(6.9e−02)		(8.2e−02)	
f_9	5.8e+00	5.8e+00	·	5.7e+00	·	5.8e+00	·
	(5.5e−01)	(5.1e−01)		(6.9e−01)		(7.4e−01)	
f_{10}	4.6e+00	4.7e+00	·	4.1e+00	·	4.4e+00	·
	(1.2e+00)	(1.6e+00)		(1.2e+00)		(1.1e+00)	
f_{11}	0.0e+00	0.0e+00	·	0.0e+00	·	2.7e−02	+
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(3.8e−02)	
f_{12}	2.6e+01	2.4e+01	·	2.3e+01	·	2.5e+01	·
	(4.5e+00)	(4.6e+00)		(4.2e+00)		(3.7e+00)	
f_{13}	2.7e+01	2.7e+01	·	2.8e+01	·	2.8e+01	·
	(5.7e+00)	(5.7e+00)		(5.9e+00)		(5.5e+00)	
f_{14}	4.1e−01	3.7e−03	−	6.1e−02	−	2.9e+01	+
	(2.1e−01)	(1.5e−02)		(5.2e−02)		(8.1e+00)	
f_{15}	1.1e+03	1.1e+03	·	1.0e+03	·	1.0e+03	·
	(1.8e+02)	(1.4e+02)		(1.4e+02)		(1.5e+02)	
f_{16}	1.1e+00	1.1e+00	·	1.1e+00	·	1.1e+00	·
	(2.2e−01)	(1.7e−01)		(2.1e−01)		(2.1e−01)	
f_{17}	1.0e+01	1.0e+01	+	8.6e+00	−	1.2e+01	+
	(9.8e−01)	(3.6e−02)		(3.5e+00)		(3.7e−01)	
f_{18}	4.1e+01	4.1e+01	·	4.4e+01	·	4.2e+01	·
	(5.1e+00)	(4.8e+00)		(5.0e+00)		(4.3e+00)	
f_{19}	4.2e−01	4.1e−01	·	5.0e−01	·	5.1e−01	·
	(1.3e−01)	(1.2e−01)		(1.2e−01)		(1.3e−01)	
f_{20}	3.4e+00	3.3e+00	·	3.3e+00	·	3.3e+00	·
	(1.9e−01)	(2.3e−01)		(2.8e−01)		(2.5e−01)	
f_{21}	2.4e+02	2.4e+02	·	2.1e+02	−	2.9e+02	+
	(4.2e+01)	(3.8e+01)		(5.5e+01)		(5.3e+01)	
f_{22}	9.6e+01	6.0e+01	−	6.1e+00	−	1.0e+02	·
	(2.3e+01)	(1.7e+01)		(7.8e+00)		(2.3e+01)	
f_{23}	1.3e+03	1.3e+03	·	1.2e+03	·	1.3e+03	·
	(2.1e+02)	(1.8e+02)		(1.8e+02)		(1.5e+02)	
f_{24}	1.5e+02	1.5e+02	·	1.4e+02	−	1.5e+02	·
	(8.2e+00)	(8.6e+00)		(6.8e+00)		(8.6e+00)	
f_{25}	1.9e+02	1.9e+02	·	1.7e+02	·	1.9e+02	·
	(2.1e+01)	(2.0e+01)		(2.9e+01)		(2.0e+01)	
f_{26}	1.4e+02	1.4e+02	·	1.3e+02	−	1.4e+02	·
	(7.1e+00)	(7.8e+00)		(7.4e+00)		(6.1e+00)	
f_{27}	4.1e+02	4.1e+02	·	4.0e+02	·	4.1e+02	·
	(1.7e+01)	(1.1e+01)		(1.3e+01)		(1.1e+01)	
f_{28}	2.8e+02	2.6e+02	·	2.2e+02	−	3.2e+02	+
	(4.7e+01)	(5.3e+01)		(9.2e+01)		(4.2e+01)	
Summary (+/·/−)		1/25/2		0/18/10		5/23/0	

Table 41: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	5.1e−01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(2.3e−01)		(0.0e+00)		(0.0e+00)	
f_2	1.6e+06	3.0e+06	+	1.5e+06	·	1.6e+06	·
	(1.0e+06)	(1.3e+06)		(7.9e+05)		(1.0e+06)	
f_3	4.0e+06	1.1e+08	+	2.7e+06	·	8.9e+06	+
	(5.9e+06)	(4.9e+07)		(2.8e+06)		(5.7e+06)	
f_4	1.0e+04	1.2e+04	·	9.6e+03	·	9.5e+03	·
	(3.5e+03)	(3.3e+03)		(3.4e+03)		(2.8e+03)	
f_5	0.0e+00	5.0e−01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.6e−01)		(0.0e+00)		(0.0e+00)	
f_6	5.4e+00	6.3e+00	·	6.7e+00	·	5.1e+00	·
	(4.5e+00)	(3.0e+00)		(4.1e+00)		(4.3e+00)	
f_7	1.3e+01	2.9e+01	+	1.4e+01	·	1.4e+01	·
	(5.8e+00)	(7.2e+00)		(4.4e+00)		(5.2e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(6.7e−02)	(6.3e−02)		(6.9e−02)		(8.2e−02)	
f_9	5.4e+00	5.7e+00	·	5.3e+00	·	5.4e+00	·
	(7.6e−01)	(7.0e−01)		(8.0e−01)		(8.1e−01)	
f_{10}	1.4e+00	7.7e+00	+	1.4e+00	·	1.7e+00	+
	(2.4e−01)	(2.7e+00)		(2.2e−01)		(2.8e−01)	
f_{11}	0.0e+00	1.4e+00	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(4.5e−01)		(0.0e+00)		(0.0e+00)	
f_{12}	1.5e+01	2.5e+01	+	1.5e+01	·	1.4e+01	·
	(3.6e+00)	(4.8e+00)		(3.6e+00)		(3.2e+00)	
f_{13}	1.7e+01	3.0e+01	+	1.7e+01	·	1.8e+01	·
	(5.7e+00)	(5.6e+00)		(4.2e+00)		(4.8e+00)	
f_{14}	4.0e+00	1.8e+01	+	9.2e−01	·	9.9e+00	+
	(1.7e+01)	(4.9e+00)		(1.6e+00)		(4.6e+00)	
f_{15}	9.5e+02	1.1e+03	·	9.6e+02	·	9.9e+02	·
	(1.8e+02)	(1.8e+02)		(2.1e+02)		(1.8e+02)	
f_{16}	1.1e+00	1.1e+00	·	1.1e+00	·	1.1e+00	·
	(2.0e−01)	(2.0e−01)		(2.2e−01)		(2.3e−01)	
f_{17}	9.3e+00	1.3e+01	+	9.5e+00	·	9.8e+00	+
	(2.7e+00)	(1.1e+00)		(2.4e+00)		(2.5e+00)	
f_{18}	3.3e+01	4.7e+01	+	3.4e+01	·	3.3e+01	·
	(4.4e+00)	(4.6e+00)		(4.5e+00)		(4.1e+00)	
f_{19}	3.7e−01	9.1e−01	+	4.0e−01	·	4.2e−01	·
	(1.1e−01)	(1.9e−01)		(1.3e−01)		(1.1e−01)	
f_{20}	3.1e+00	3.3e+00	+	3.1e+00	·	3.2e+00	·
	(2.8e−01)	(2.4e−01)		(3.0e−01)		(3.2e−01)	
f_{21}	3.8e+02	2.4e+02	−	3.8e+02	·	3.8e+02	+
	(7.3e+01)	(3.1e+01)		(6.0e+01)		(5.3e+01)	
f_{22}	8.1e+01	8.6e+01	·	6.8e+01	·	1.0e+02	+
	(7.4e+01)	(2.2e+01)		(6.3e+01)		(6.3e+01)	
f_{23}	1.1e+03	1.3e+03	+	1.1e+03	·	1.1e+03	·
	(2.3e+02)	(1.9e+02)		(2.0e+02)		(1.7e+02)	
f_{24}	1.7e+02	1.5e+02	·	1.7e+02	·	1.6e+02	·
	(3.7e+01)	(8.4e+00)		(3.4e+01)		(3.3e+01)	
f_{25}	2.0e+02	2.0e+02	·	2.1e+02	·	2.1e+02	·
	(1.9e+01)	(1.7e+01)		(1.7e+01)		(1.8e+01)	
f_{26}	1.5e+02	1.4e+02	·	1.5e+02	·	1.5e+02	·
	(3.4e+01)	(7.0e+00)		(3.7e+01)		(3.4e+01)	
f_{27}	3.6e+02	4.1e+02	+	3.6e+02	·	3.7e+02	·
	(5.5e+01)	(1.3e+01)		(5.8e+01)		(2.3e+01)	
f_{28}	2.8e+02	2.8e+02	·	2.5e+02	·	2.8e+02	+
	(9.1e+01)	(7.5e+01)		(9.2e+01)		(8.6e+01)	
Summary (+/·/−)		16/11/1		0/28/0		7/21/0	

Table 42: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	2.9e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.8e+01)		(0.0e+00)		(0.0e+00)	
f_2	2.0e+06	3.3e+06	+	2.0e+06	·	1.8e+06	·
	(9.9e+05)	(1.4e+06)		(1.3e+06)		(8.6e+05)	
f_3	1.9e+07	1.6e+08	+	1.4e+07	·	2.8e+07	·
	(1.2e+07)	(1.1e+08)		(9.2e+06)		(2.1e+07)	
f_4	9.9e+03	1.3e+04	+	1.0e+04	·	1.0e+04	·
	(3.1e+03)	(3.3e+03)		(2.9e+03)		(3.8e+03)	
f_5	0.0e+00	2.7e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(5.9e+01)		(0.0e+00)		(0.0e+00)	
f_6	3.3e+00	1.8e+01	+	3.7e+00	·	2.6e+00	·
	(3.2e+00)	(6.7e+00)		(3.4e+00)		(2.4e+00)	
f_7	1.8e+01	3.0e+01	+	1.7e+01	·	1.8e+01	·
	(4.6e+00)	(7.7e+00)		(5.7e+00)		(5.3e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(7.8e−02)	(6.4e−02)		(8.4e−02)		(8.3e−02)	
f_9	5.5e+00	6.1e+00	+	5.5e+00	·	5.6e+00	·
	(7.1e−01)	(6.4e−01)		(7.9e−01)		(9.5e−01)	
f_{10}	2.5e+00	7.5e+00	+	2.1e+00	·	2.7e+00	·
	(7.3e−01)	(3.0e+00)		(5.1e−01)		(7.3e−01)	
f_{11}	0.0e+00	9.7e+00	+	3.9e−02	·	5.9e−09	·
	(0.0e+00)	(3.1e+00)		(2.0e−01)		(4.2e−08)	
f_{12}	1.7e+01	2.7e+01	+	1.8e+01	·	1.8e+01	·
	(3.1e+00)	(3.9e+00)		(4.0e+00)		(3.8e+00)	
f_{13}	2.3e+01	2.8e+01	·	2.0e+01	·	2.0e+01	·
	(5.2e+00)	(5.5e+00)		(5.4e+00)		(5.5e+00)	
f_{14}	1.5e−01	1.1e+02	+	6.3e−01	·	1.8e+01	+
	(9.5e−02)	(6.6e+01)		(1.1e+00)		(4.6e+00)	
f_{15}	1.1e+03	1.2e+03	·	9.9e+02	·	9.9e+02	·
	(1.4e+02)	(1.7e+02)		(1.9e+02)		(1.8e+02)	
f_{16}	1.1e+00	1.1e+00	·	1.1e+00	·	1.1e+00	·
	(1.7e−01)	(2.0e−01)		(1.6e−01)		(1.6e−01)	
f_{17}	9.8e+00	2.8e+01	+	9.9e+00	+	1.1e+01	+
	(1.8e+00)	(5.1e+00)		(1.5e+00)		(1.1e+00)	
f_{18}	3.8e+01	4.2e+01	+	3.8e+01	·	3.8e+01	·
	(5.6e+00)	(4.6e+00)		(4.2e+00)		(4.9e+00)	
f_{19}	4.4e−01	1.7e+00	+	4.0e−01	·	4.3e−01	·
	(1.3e−01)	(4.7e−01)		(1.5e−01)		(1.4e−01)	
f_{20}	3.2e+00	3.3e+00	+	3.1e+00	·	3.2e+00	·
	(2.6e−01)	(2.6e−01)		(2.7e−01)		(2.8e−01)	
f_{21}	3.4e+02	3.8e+02	+	3.2e+02	·	3.5e+02	+
	(8.7e+01)	(3.8e+01)		(1.0e+02)		(1.0e+02)	
f_{22}	7.5e+01	2.1e+02	+	5.8e+01	−	9.2e+01	·
	(4.4e+01)	(7.1e+01)		(5.8e+01)		(3.3e+01)	
f_{23}	1.1e+03	1.4e+03	+	1.1e+03	·	1.2e+03	·
	(1.8e+02)	(1.5e+02)		(1.5e+02)		(1.7e+02)	
f_{24}	1.5e+02	1.6e+02	·	1.4e+02	·	1.5e+02	·
	(2.6e+01)	(1.5e+01)		(2.1e+01)		(2.2e+01)	
f_{25}	1.8e+02	2.0e+02	+	1.9e+02	·	1.9e+02	·
	(3.0e+01)	(1.6e+01)		(3.1e+01)		(2.9e+01)	
f_{26}	1.3e+02	1.4e+02	+	1.3e+02	·	1.4e+02	·
	(1.5e+01)	(9.0e+00)		(9.4e+00)		(1.9e+01)	
f_{27}	3.9e+02	4.2e+02	+	3.9e+02	·	4.0e+02	·
	(2.7e+01)	(2.2e+01)		(2.3e+01)		(1.8e+01)	
f_{28}	2.7e+02	4.4e+02	+	2.6e+02	−	2.8e+02	+
	(7.2e+01)	(5.9e+01)		(7.7e+01)		(7.5e+01)	
Summary (+/·/−)		23/5/0		1/25/2		4/24/0	

Table 43: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	2.9e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.6e+01)		(0.0e+00)		(0.0e+00)	
f_2	2.2e+06	3.5e+06	+	1.9e+06	·	2.6e+06	·
	(1.2e+06)	(1.5e+06)		(1.0e+06)		(1.2e+06)	
f_3	2.9e+07	1.8e+08	+	1.2e+07	−	5.4e+07	+
	(2.0e+07)	(1.2e+08)		(8.3e+06)		(3.5e+07)	
f_4	1.2e+04	1.3e+04	·	9.7e+03	·	1.1e+04	·
	(3.5e+03)	(4.1e+03)		(3.3e+03)		(2.9e+03)	
f_5	0.0e+00	1.7e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.8e+01)		(0.0e+00)		(0.0e+00)	
f_6	4.8e+00	1.9e+01	+	4.0e+00	·	7.8e+00	+
	(2.9e+00)	(5.8e+00)		(3.8e+00)		(2.7e+00)	
f_7	2.5e+01	3.2e+01	+	1.8e+01	−	2.7e+01	·
	(7.0e+00)	(8.2e+00)		(4.5e+00)		(5.4e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(6.6e−02)	(7.9e−02)		(7.9e−02)		(6.5e−02)	
f_9	5.3e+00	6.1e+00	+	5.6e+00	·	5.5e+00	·
	(6.3e−01)	(6.1e−01)		(7.6e−01)		(7.4e−01)	
f_{10}	1.5e+00	8.1e+00	+	2.2e+00	+	2.1e+00	+
	(2.5e−01)	(3.9e+00)		(5.7e−01)		(5.8e−01)	
f_{11}	0.0e+00	1.1e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(3.7e+00)		(0.0e+00)		(0.0e+00)	
f_{12}	1.9e+01	2.6e+01	+	1.9e+01	·	1.8e+01	·
	(3.5e+00)	(4.8e+00)		(4.1e+00)		(3.8e+00)	
f_{13}	2.3e+01	2.7e+01	·	1.9e+01	−	2.1e+01	·
	(5.6e+00)	(5.4e+00)		(5.0e+00)		(5.3e+00)	
f_{14}	8.3e−01	1.1e+02	+	7.0e−01	−	1.4e+01	+
	(5.1e−01)	(5.7e+01)		(1.8e+00)		(4.0e+00)	
f_{15}	9.5e+02	1.1e+03	+	1.0e+03	·	1.0e+03	·
	(1.3e+02)	(1.5e+02)		(1.5e+02)		(1.6e+02)	
f_{16}	1.1e+00	1.1e+00	·	1.1e+00	·	1.1e+00	·
	(1.9e−01)	(1.9e−01)		(2.0e−01)		(2.3e−01)	
f_{17}	1.0e+01	2.8e+01	+	1.0e+01	+	1.1e+01	+
	(1.0e−10)	(4.7e+00)		(1.3e+00)		(1.8e−01)	
f_{18}	3.4e+01	4.3e+01	+	3.9e+01	+	3.4e+01	·
	(4.4e+00)	(5.2e+00)		(5.3e+00)		(4.0e+00)	
f_{19}	1.1e−01	1.7e+00	+	4.3e−01	+	3.3e−01	+
	(7.7e−02)	(5.0e−01)		(1.4e−01)		(6.5e−02)	
f_{20}	3.3e+00	3.4e+00	·	3.2e+00	·	3.4e+00	·
	(2.7e−01)	(1.6e−01)		(2.6e−01)		(2.1e−01)	
f_{21}	3.3e+02	3.8e+02	+	3.5e+02	·	3.9e+02	+
	(8.4e+01)	(3.9e+01)		(8.3e+01)		(2.3e+01)	
f_{22}	5.3e+01	2.1e+02	+	7.4e+01	·	8.1e+01	+
	(1.5e+01)	(7.6e+01)		(7.0e+01)		(2.1e+01)	
f_{23}	1.3e+03	1.3e+03	·	1.1e+03	·	1.3e+03	·
	(1.7e+02)	(1.7e+02)		(2.4e+02)		(1.7e+02)	
f_{24}	1.4e+02	1.6e+02	+	1.4e+02	·	1.6e+02	+
	(6.9e+00)	(1.4e+01)		(2.2e+01)		(1.1e+01)	
f_{25}	1.7e+02	2.0e+02	+	1.9e+02	+	2.0e+02	+
	(1.9e+01)	(1.6e+01)		(2.8e+01)		(1.8e+01)	
f_{26}	1.3e+02	1.4e+02	·	1.3e+02	·	1.4e+02	+
	(5.3e+00)	(8.6e+00)		(1.3e+01)		(6.8e+00)	
f_{27}	3.7e+02	4.2e+02	+	3.9e+02	·	3.8e+02	+
	(1.2e+01)	(2.5e+01)		(3.0e+01)		(1.4e+01)	
f_{28}	2.7e+02	4.6e+02	+	2.7e+02	·	3.2e+02	+
	(5.5e+01)	(4.4e+01)		(7.3e+01)		(8.1e+00)	
Summary (+/·/−)		21/7/0		5/19/4		13/15/0	

Table 44: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	7.8e−02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(4.2e−02)		(0.0e+00)		(0.0e+00)	
f_2	1.3e+06	2.5e+06	+	1.9e+06	·	1.8e+06	·
	(7.7e+05)	(1.2e+06)		(1.1e+06)		(9.5e+05)	
f_3	3.1e+06	5.6e+07	+	8.8e+06	+	1.3e+07	+
	(2.8e+06)	(3.1e+07)		(1.1e+07)		(5.8e+06)	
f_4	8.7e+03	1.3e+04	+	1.1e+04	·	1.0e+04	·
	(3.1e+03)	(3.3e+03)		(3.2e+03)		(3.0e+03)	
f_5	0.0e+00	1.4e−01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(4.0e−02)		(0.0e+00)		(0.0e+00)	
f_6	2.0e+00	6.8e+00	+	4.3e+00	+	3.8e+00	+
	(3.1e+00)	(2.7e+00)		(3.8e+00)		(3.3e+00)	
f_7	1.5e+01	2.9e+01	+	1.5e+01	·	1.6e+01	·
	(5.9e+00)	(7.3e+00)		(4.5e+00)		(4.7e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(6.6e−02)	(8.4e−02)		(8.7e−02)		(6.8e−02)	
f_9	5.3e+00	5.7e+00	·	5.6e+00	·	5.6e+00	·
	(6.4e−01)	(6.0e−01)		(7.8e−01)		(7.8e−01)	
f_{10}	1.1e+00	4.1e+00	+	1.7e+00	+	2.1e+00	+
	(2.1e−01)	(1.4e+00)		(4.4e−01)		(5.6e−01)	
f_{11}	0.0e+00	3.7e−01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.3e−01)		(0.0e+00)		(0.0e+00)	
f_{12}	1.5e+01	2.0e+01	+	1.7e+01	·	1.5e+01	·
	(3.3e+00)	(3.8e+00)		(4.1e+00)		(3.5e+00)	
f_{13}	1.7e+01	2.4e+01	+	2.0e+01	·	1.8e+01	·
	(4.9e+00)	(4.3e+00)		(4.6e+00)		(5.0e+00)	
f_{14}	1.7e−01	8.9e+00	+	1.7e+00	+	1.3e+01	+
	(6.4e−02)	(3.0e+00)		(1.9e+00)		(4.7e+00)	
f_{15}	8.8e+02	1.0e+03	+	9.6e+02	·	9.8e+02	·
	(1.7e+02)	(1.7e+02)		(1.8e+02)		(1.4e+02)	
f_{16}	1.0e+00	1.1e+00	·	1.0e+00	·	1.1e+00	·
	(1.9e−01)	(1.9e−01)		(1.8e−01)		(2.3e−01)	
f_{17}	1.0e+01	1.2e+01	+	1.0e+01	+	1.0e+01	+
	(8.1e−14)	(3.6e−01)		(1.4e+00)		(1.2e+00)	
f_{18}	3.4e+01	4.1e+01	+	3.7e+01	·	3.5e+01	·
	(4.1e+00)	(6.1e+00)		(4.6e+00)		(3.7e+00)	
f_{19}	3.1e−01	5.7e−01	+	4.0e−01	+	4.0e−01	·
	(1.2e−01)	(1.5e−01)		(1.2e−01)		(1.3e−01)	
f_{20}	3.1e+00	3.3e+00	+	3.1e+00	·	3.1e+00	·
	(3.1e−01)	(2.2e−01)		(2.8e−01)		(3.2e−01)	
f_{21}	3.8e+02	3.0e+02	−	3.7e+02	·	3.8e+02	+
	(6.3e+01)	(5.9e+01)		(7.0e+01)		(5.8e+01)	
f_{22}	3.7e+01	6.4e+01	+	7.6e+01	·	8.5e+01	+
	(2.5e+01)	(1.7e+01)		(7.1e+01)		(4.5e+01)	
f_{23}	1.1e+03	1.3e+03	+	1.1e+03	·	1.1e+03	·
	(2.1e+02)	(1.7e+02)		(1.8e+02)		(2.0e+02)	
f_{24}	1.3e+02	1.5e+02	+	1.5e+02	+	1.6e+02	+
	(7.8e+00)	(1.0e+01)		(2.3e+01)		(2.5e+01)	
f_{25}	1.8e+02	1.9e+02	·	1.9e+02	·	2.0e+02	·
	(3.0e+01)	(1.7e+01)		(2.7e+01)		(2.4e+01)	
f_{26}	1.3e+02	1.4e+02	+	1.4e+02	+	1.4e+02	+
	(7.7e+00)	(6.9e+00)		(2.3e+01)		(1.8e+01)	
f_{27}	3.5e+02	4.0e+02	+	3.8e+02	+	3.8e+02	+
	(1.4e+01)	(2.1e+01)		(3.7e+01)		(1.3e+01)	
f_{28}	2.4e+02	3.2e+02	+	2.7e+02	−	2.9e+02	+
	(9.1e+01)	(3.1e+01)		(6.8e+01)		(5.9e+01)	
Summary (+/·/−)		23/4/1		9/18/1		11/17/0	

Table 45: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	3.2e+06	2.8e+06	·	2.1e+06	−	2.4e+06	·
	(1.6e+06)	(1.3e+06)		(1.0e+06)		(1.1e+06)	
f_3	4.2e+07	5.1e+07	·	3.2e+07	·	6.7e+07	+
	(2.3e+07)	(3.5e+07)		(2.2e+07)		(3.2e+07)	
f_4	1.3e+04	1.2e+04	·	1.1e+04	·	1.2e+04	·
	(3.9e+03)	(3.6e+03)		(3.6e+03)		(2.9e+03)	
f_5	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_6	7.1e+00	6.9e+00	·	3.6e+00	−	6.5e+00	·
	(2.6e+00)	(2.6e+00)		(3.6e+00)		(2.7e+00)	
f_7	2.9e+01	2.7e+01	·	2.1e+01	−	2.8e+01	·
	(7.8e+00)	(7.1e+00)		(5.2e+00)		(5.5e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(8.6e−02)	(6.9e−02)		(8.3e−02)		(8.5e−02)	
f_9	5.8e+00	5.6e+00	·	5.6e+00	·	5.8e+00	·
	(6.7e−01)	(7.9e−01)		(7.6e−01)		(6.9e−01)	
f_{10}	3.4e+00	3.2e+00	−	3.1e+00	·	3.5e+00	·
	(1.1e+00)	(9.2e−01)		(8.6e−01)		(1.1e+00)	
f_{11}	0.0e+00	0.0e+00	·	0.0e+00	·	3.8e−06	+
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(1.3e−05)	
f_{12}	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.0e+00)	(3.5e+00)		(4.8e+00)		(3.7e+00)	
f_{13}	2.5e+01	2.4e+01	·	2.4e+01	·	2.4e+01	·
	(4.3e+00)	(5.4e+00)		(5.1e+00)		(4.8e+00)	
f_{14}	3.8e−02	6.1e−03	−	8.6e−01	+	2.1e+01	+
	(5.0e−02)	(1.9e−02)		(1.5e+00)		(6.3e+00)	
f_{15}	1.0e+03	1.1e+03	·	1.0e+03	·	1.0e+03	·
	(1.6e+02)	(1.6e+02)		(1.8e+02)		(1.7e+02)	
f_{16}	1.1e+00	1.1e+00	·	1.1e+00	·	1.1e+00	·
	(2.0e−01)	(2.1e−01)		(2.1e−01)		(2.0e−01)	
f_{17}	1.0e+01	1.0e+01	+	1.0e+01	+	1.1e+01	+
	(1.1e−06)	(2.1e−03)		(8.5e−02)		(2.8e−01)	
f_{18}	3.8e+01	3.8e+01	·	4.1e+01	+	3.8e+01	·
	(4.7e+00)	(5.3e+00)		(4.7e+00)		(5.0e+00)	
f_{19}	3.5e−01	3.0e−01	·	4.5e−01	·	4.0e−01	·
	(1.1e−01)	(9.0e−02)		(1.4e−01)		(1.1e−01)	
f_{20}	3.3e+00	3.4e+00	·	3.2e+00	·	3.3e+00	·
	(2.4e−01)	(2.3e−01)		(2.6e−01)		(2.2e−01)	
f_{21}	3.0e+02	3.0e+02	·	2.6e+02	·	3.6e+02	+
	(5.7e+01)	(5.3e+01)		(9.6e+01)		(4.3e+01)	
f_{22}	6.6e+01	4.8e+01	−	6.2e+01	·	8.7e+01	·
	(2.1e+01)	(1.5e+01)		(5.8e+01)		(1.9e+01)	
f_{23}	1.3e+03	1.3e+03	·	1.2e+03	·	1.3e+03	·
	(1.7e+02)	(1.7e+02)		(1.6e+02)		(1.8e+02)	
f_{24}	1.5e+02	1.5e+02	·	1.4e+02	−	1.5e+02	·
	(6.8e+00)	(1.1e+01)		(1.4e+01)		(1.1e+01)	
f_{25}	2.0e+02	2.0e+02	·	1.9e+02	·	1.9e+02	·
	(1.9e+01)	(1.7e+01)		(2.4e+01)		(1.9e+01)	
f_{26}	1.4e+02	1.4e+02	·	1.3e+02	·	1.4e+02	·
	(7.4e+00)	(8.0e+00)		(7.9e+00)		(8.1e+00)	
f_{27}	4.0e+02	4.0e+02	·	4.0e+02	·	4.0e+02	·
	(1.4e+01)	(1.7e+01)		(1.6e+01)		(1.4e+01)	
f_{28}	2.9e+02	2.9e+02	·	2.5e+02	−	3.3e+02	+
	(2.1e+01)	(2.5e+01)		(8.4e+01)		(1.4e+01)	
Summary (+/·/−)		1/24/3		3/20/5		6/22/0	

Table 46: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	5.0e−03	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(2.5e−03)		(0.0e+00)		(0.0e+00)	
f_2	1.6e+06	3.0e+06	+	1.9e+06	·	2.0e+06	·
	(7.3e+05)	(1.4e+06)		(1.1e+06)		(1.1e+06)	
f_3	3.7e+06	3.5e+07	+	9.0e+06	+	2.1e+07	+
	(2.4e+06)	(2.6e+07)		(5.5e+06)		(1.1e+07)	
f_4	9.8e+03	1.3e+04	·	9.9e+03	·	1.0e+04	·
	(3.0e+03)	(3.4e+03)		(3.2e+03)		(3.2e+03)	
f_5	0.0e+00	2.2e−02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(8.6e−03)		(0.0e+00)		(0.0e+00)	
f_6	3.3e+00	8.4e+00	+	4.9e+00	·	3.2e+00	·
	(3.8e+00)	(2.1e+00)		(4.0e+00)		(3.0e+00)	
f_7	1.6e+01	2.9e+01	+	1.6e+01	·	1.8e+01	·
	(4.7e+00)	(6.2e+00)		(5.1e+00)		(4.5e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(8.6e−02)	(7.4e−02)		(6.8e−02)		(6.6e−02)	
f_9	5.5e+00	5.5e+00	·	5.5e+00	·	5.4e+00	·
	(5.9e−01)	(8.3e−01)		(7.6e−01)		(7.8e−01)	
f_{10}	1.1e+00	2.8e+00	+	2.1e+00	+	2.6e+00	+
	(2.1e−01)	(7.7e−01)		(7.2e−01)		(5.9e−01)	
f_{11}	0.0e+00	2.6e−02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.2e−02)		(0.0e+00)		(0.0e+00)	
f_{12}	1.6e+01	2.0e+01	+	1.8e+01	·	1.8e+01	·
	(2.8e+00)	(4.2e+00)		(4.2e+00)		(3.6e+00)	
f_{13}	1.9e+01	2.3e+01	·	2.1e+01	·	1.9e+01	·
	(4.7e+00)	(5.8e+00)		(4.4e+00)		(5.1e+00)	
f_{14}	1.4e−01	2.3e+00	+	3.2e+00	·	1.6e+01	+
	(5.8e−02)	(1.0e+00)		(1.7e+01)		(5.3e+00)	
f_{15}	9.1e+02	1.0e+03	·	9.8e+02	·	9.6e+02	·
	(1.7e+02)	(1.4e+02)		(2.0e+02)		(1.6e+02)	
f_{16}	1.0e+00	1.1e+00	·	1.1e+00	·	1.1e+00	·
	(1.9e−01)	(1.7e−01)		(2.0e−01)		(2.1e−01)	
f_{17}	1.0e+01	1.1e+01	+	1.0e+01	+	1.1e+01	+
	(6.6e−13)	(1.3e−01)		(1.1e−01)		(1.4e+00)	
f_{18}	3.4e+01	3.8e+01	+	3.7e+01	+	3.7e+01	·
	(4.2e+00)	(4.9e+00)		(4.5e+00)		(5.0e+00)	
f_{19}	3.4e−01	2.4e−01	−	4.4e−01	+	4.1e−01	·
	(1.1e−01)	(1.1e−01)		(1.3e−01)		(1.4e−01)	
f_{20}	3.1e+00	3.3e+00	·	3.2e+00	·	3.2e+00	·
	(3.2e−01)	(2.4e−01)		(2.3e−01)		(2.5e−01)	
f_{21}	3.8e+02	3.3e+02	·	3.5e+02	·	3.7e+02	+
	(5.4e+01)	(6.8e+01)		(8.9e+01)		(7.1e+01)	
f_{22}	2.9e+01	4.8e+01	+	7.5e+01	·	9.6e+01	+
	(9.6e+00)	(2.1e+01)		(7.6e+01)		(4.3e+01)	
f_{23}	1.1e+03	1.2e+03	·	1.2e+03	·	1.1e+03	·
	(1.8e+02)	(1.6e+02)		(2.1e+02)		(1.8e+02)	
f_{24}	1.3e+02	1.5e+02	+	1.5e+02	·	1.5e+02	+
	(6.3e+00)	(1.4e+01)		(2.6e+01)		(1.8e+01)	
f_{25}	1.8e+02	1.9e+02	·	1.9e+02	·	1.9e+02	·
	(2.5e+01)	(2.0e+01)		(2.9e+01)		(2.7e+01)	
f_{26}	1.3e+02	1.3e+02	+	1.3e+02	·	1.4e+02	·
	(8.0e+00)	(1.1e+01)		(1.2e+01)		(1.5e+01)	
f_{27}	3.5e+02	3.8e+02	+	3.8e+02	+	3.9e+02	+
	(1.3e+01)	(1.9e+01)		(2.8e+01)		(2.1e+01)	
f_{28}	2.3e+02	2.9e+02	+	2.5e+02	·	2.5e+02	+
	(9.5e+01)	(4.0e+01)		(8.7e+01)		(9.0e+01)	
Summary (+/·/−)		17/10/1		6/22/0		9/19/0	

Table 47: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	2.0e+06	2.0e+06	·	1.3e+06	−	1.7e+06	·
	(8.3e+05)	(9.1e+05)		(6.9e+05)		(7.8e+05)	
f_3	3.6e+05	4.7e+05	·	1.8e+05	−	6.7e+06	+
	(3.1e+05)	(4.9e+05)		(2.7e+05)		(3.7e+06)	
f_4	1.1e+04	1.0e+04	·	7.6e+03	−	9.7e+03	·
	(3.0e+03)	(3.5e+03)		(2.3e+03)		(2.8e+03)	
f_5	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_6	9.6e+00	9.5e+00	·	5.6e+00	−	8.0e+00	·
	(8.3e−01)	(1.4e+00)		(4.3e+00)		(2.2e+00)	
f_7	7.4e+00	7.7e+00	·	6.2e+00	·	1.2e+01	+
	(2.1e+00)	(2.4e+00)		(2.4e+00)		(3.0e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(5.8e−02)	(8.1e−02)		(6.7e−02)		(7.3e−02)	
f_9	6.0e+00	5.9e+00	·	5.4e+00	·	6.0e+00	·
	(5.7e−01)	(6.0e−01)		(9.1e−01)		(7.0e−01)	
f_{10}	1.1e+00	1.1e+00	·	1.0e+00	·	1.2e+00	+
	(1.1e−01)	(1.1e−01)		(1.3e−01)		(1.2e−01)	
f_{11}	0.0e+00	0.0e+00	·	2.0e−02	·	1.0e+00	+
	(0.0e+00)	(0.0e+00)		(1.4e−01)		(3.1e−01)	
f_{12}	2.0e+01	1.9e+01	·	2.2e+01	·	1.9e+01	·
	(4.0e+00)	(3.3e+00)		(3.8e+00)		(3.1e+00)	
f_{13}	2.0e+01	2.0e+01	·	2.1e+01	·	2.0e+01	·
	(3.4e+00)	(3.6e+00)		(4.5e+00)		(4.3e+00)	
f_{14}	6.0e−02	5.9e−02	·	7.8e+00	+	8.0e+01	+
	(5.3e−02)	(5.6e−02)		(7.9e+00)		(1.9e+01)	
f_{15}	1.2e+03	1.2e+03	·	1.2e+03	·	1.2e+03	·
	(1.4e+02)	(1.6e+02)		(1.2e+02)		(1.4e+02)	
f_{16}	1.1e+00	1.1e+00	·	1.1e+00	·	1.1e+00	·
	(2.1e−01)	(2.1e−01)		(1.8e−01)		(1.5e−01)	
f_{17}	1.0e+01	1.0e+01	·	1.0e+01	+	1.2e+01	+
	(1.8e−15)	(1.0e−12)		(2.0e+00)		(3.7e−01)	
f_{18}	3.5e+01	3.5e+01	·	3.8e+01	·	3.6e+01	·
	(4.4e+00)	(3.7e+00)		(4.1e+00)		(3.4e+00)	
f_{19}	6.7e−01	6.6e−01	·	7.2e−01	·	6.8e−01	·
	(9.1e−02)	(8.5e−02)		(1.0e−01)		(7.6e−02)	
f_{20}	3.2e+00	3.2e+00	·	2.9e+00	−	3.2e+00	·
	(2.3e−01)	(2.1e−01)		(2.6e−01)		(1.9e−01)	
f_{21}	3.8e+02	3.8e+02	·	3.7e+02	·	4.0e+02	·
	(3.5e+01)	(4.8e+01)		(7.9e+01)		(4.9e+00)	
f_{22}	8.6e+01	7.9e+01	·	7.3e+01	·	1.9e+02	+
	(3.3e+01)	(2.9e+01)		(6.1e+01)		(4.4e+01)	
f_{23}	1.3e+03	1.3e+03	·	1.2e+03	·	1.3e+03	·
	(1.9e+02)	(1.8e+02)		(1.6e+02)		(1.6e+02)	
f_{24}	1.9e+02	1.9e+02	·	2.0e+02	·	1.9e+02	·
	(2.2e+01)	(2.0e+01)		(2.3e+01)		(1.6e+01)	
f_{25}	2.1e+02	2.1e+02	·	2.1e+02	·	2.1e+02	·
	(6.8e+00)	(6.8e+00)		(1.1e+01)		(8.0e+00)	
f_{26}	1.4e+02	1.4e+02	·	1.5e+02	·	1.4e+02	+
	(9.2e+00)	(8.4e+00)		(3.2e+01)		(9.1e+00)	
f_{27}	3.6e+02	3.6e+02	·	3.4e+02	−	3.9e+02	+
	(4.3e+01)	(4.5e+01)		(7.0e+01)		(1.7e+01)	
f_{28}	3.0e+02	3.0e+02	·	2.8e+02	·	3.1e+02	+
	(8.0e+00)	(1.5e+00)		(6.0e+01)		(1.1e+01)	
Summary (+/·/−)		0/28/0		2/20/6		10/18/0	

Table 48: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	2.1e+06	2.2e+06	·	1.6e+06	·	2.2e+06	·
	(8.7e+05)	(7.9e+05)		(8.3e+05)		(8.9e+05)	
f_3	8.8e+06	3.6e+06	−	1.1e+06	−	2.0e+07	+
	(5.7e+06)	(2.1e+06)		(1.2e+06)		(1.0e+07)	
f_4	1.1e+04	1.0e+04	·	7.9e+03	−	9.8e+03	·
	(2.8e+03)	(2.8e+03)		(2.3e+03)		(3.2e+03)	
f_5	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_6	7.8e+00	8.7e+00	·	4.0e+00	−	6.3e+00	·
	(2.5e+00)	(1.9e+00)		(3.8e+00)		(2.0e+00)	
f_7	1.4e+01	1.3e+01	·	9.2e+00	−	1.6e+01	+
	(3.5e+00)	(3.4e+00)		(2.7e+00)		(3.6e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(6.1e−02)	(6.7e−02)		(7.5e−02)		(7.0e−02)	
f_9	6.0e+00	6.0e+00	·	5.7e+00	·	5.9e+00	·
	(6.7e−01)	(6.3e−01)		(7.4e−01)		(7.0e−01)	
f_{10}	1.7e+00	1.6e+00	·	1.4e+00	−	1.8e+00	·
	(2.8e−01)	(2.6e−01)		(2.4e−01)		(3.3e−01)	
f_{11}	0.0e+00	0.0e+00	·	0.0e+00	·	1.6e+00	+
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(4.8e−01)	
f_{12}	2.2e+01	2.4e+01	·	2.4e+01	·	2.3e+01	·
	(4.0e+00)	(4.2e+00)		(4.7e+00)		(3.9e+00)	
f_{13}	2.4e+01	2.3e+01	·	2.4e+01	·	2.4e+01	·
	(3.8e+00)	(4.6e+00)		(6.0e+00)		(4.1e+00)	
f_{14}	2.9e+01	5.4e−02	−	1.8e−01	−	9.8e+01	+
	(6.3e+00)	(8.4e−02)		(8.9e−02)		(2.1e+01)	
f_{15}	1.2e+03	1.2e+03	·	1.2e+03	·	1.2e+03	·
	(1.5e+02)	(1.6e+02)		(1.8e+02)		(1.4e+02)	
f_{16}	1.2e+00	1.2e+00	·	1.1e+00	·	1.1e+00	·
	(2.0e−01)	(1.7e−01)		(2.1e−01)		(2.2e−01)	
f_{17}	1.0e+01	1.0e+01	+	9.3e+00	−	1.3e+01	+
	(9.4e−02)	(1.7e−01)		(2.7e+00)		(7.2e−01)	
f_{18}	3.8e+01	4.0e+01	·	4.0e+01	·	4.0e+01	·
	(5.7e+00)	(4.0e+00)		(5.0e+00)		(4.5e+00)	
f_{19}	7.7e−01	7.4e−01	·	7.6e−01	·	7.8e−01	·
	(9.7e−02)	(9.8e−02)		(1.2e−01)		(1.1e−01)	
f_{20}	3.2e+00	3.2e+00	·	3.0e+00	−	3.3e+00	·
	(1.9e−01)	(2.2e−01)		(2.2e−01)		(2.1e−01)	
f_{21}	3.1e+02	3.2e+02	·	3.0e+02	·	3.4e+02	·
	(6.6e+01)	(6.9e+01)		(9.4e+01)		(6.6e+01)	
f_{22}	1.9e+02	1.0e+02	−	2.0e+01	−	2.1e+02	·
	(3.8e+01)	(3.3e+01)		(2.3e+01)		(4.5e+01)	
f_{23}	1.3e+03	1.3e+03	·	1.3e+03	·	1.4e+03	·
	(1.7e+02)	(1.7e+02)		(2.1e+02)		(1.6e+02)	
f_{24}	1.9e+02	1.8e+02	·	1.9e+02	·	1.8e+02	·
	(1.9e+01)	(1.8e+01)		(2.9e+01)		(2.0e+01)	
f_{25}	2.1e+02	2.1e+02	·	2.1e+02	−	2.1e+02	·
	(1.1e+01)	(1.1e+01)		(1.2e+01)		(9.7e+00)	
f_{26}	1.4e+02	1.4e+02	·	1.3e+02	·	1.4e+02	·
	(8.3e+00)	(7.1e+00)		(8.5e+00)		(7.3e+00)	
f_{27}	4.3e+02	4.2e+02	·	3.4e+02	−	4.2e+02	·
	(2.4e+01)	(2.9e+01)		(4.6e+01)		(2.0e+01)	
f_{28}	3.0e+02	3.0e+02	−	2.8e+02	·	3.1e+02	+
	(1.6e+00)	(1.4e+01)		(6.0e+01)		(1.2e+01)	
Summary (+/·/−)		1/23/4		0/17/11		6/22/0	

Table 49: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	2.2e+00	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(7.7e−01)		(0.0e+00)		(0.0e+00)	
f_2	6.4e+05	2.2e+06	+	6.5e+05	·	6.2e+05	·
	(4.9e+05)	(6.9e+05)		(4.1e+05)		(3.6e+05)	
f_3	1.0e+05	9.5e+07	+	1.3e+05	·	3.2e+05	+
	(3.3e+05)	(3.5e+07)		(5.5e+05)		(3.2e+05)	
f_4	4.2e+03	1.0e+04	+	4.7e+03	·	4.6e+03	·
	(1.6e+03)	(3.3e+03)		(1.6e+03)		(1.6e+03)	
f_5	0.0e+00	1.8e+00	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(5.4e−01)		(0.0e+00)		(0.0e+00)	
f_6	7.8e+00	1.0e+01	+	7.5e+00	·	5.2e+00	·
	(1.1e+01)	(2.0e+00)		(4.1e+00)		(4.5e+00)	
f_7	7.8e−01	2.2e+01	+	1.5e+00	·	3.0e+00	+
	(1.6e+00)	(4.4e+00)		(3.6e+00)		(2.3e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(7.6e−02)	(8.1e−02)		(6.5e−02)		(8.3e−02)	
f_9	3.6e+00	5.8e+00	+	3.8e+00	·	4.8e+00	·
	(1.6e+00)	(7.0e−01)		(1.5e+00)		(1.1e+00)	
f_{10}	3.3e−01	9.4e+00	+	3.2e−01	·	5.9e−01	+
	(1.0e−01)	(3.1e+00)		(1.2e−01)		(1.6e−01)	
f_{11}	1.8e−01	2.6e+00	+	1.6e−01	·	3.9e−02	·
	(4.3e−01)	(6.5e−01)		(3.7e−01)		(2.0e−01)	
f_{12}	1.3e+01	2.9e+01	+	1.2e+01	·	1.3e+01	·
	(3.6e+00)	(4.4e+00)		(3.3e+00)		(3.2e+00)	
f_{13}	1.3e+01	3.1e+01	+	1.3e+01	·	1.3e+01	·
	(4.5e+00)	(4.8e+00)		(4.7e+00)		(3.8e+00)	
f_{14}	2.3e+01	3.1e+01	+	1.6e+01	·	4.8e+01	+
	(4.6e+01)	(9.5e+00)		(3.0e+01)		(3.7e+01)	
f_{15}	1.0e+03	1.2e+03	+	1.0e+03	·	1.0e+03	·
	(1.9e+02)	(1.5e+02)		(1.6e+02)		(1.9e+02)	
f_{16}	1.1e+00	1.1e+00	·	1.1e+00	·	1.1e+00	·
	(1.8e−01)	(2.1e−01)		(1.7e−01)		(2.1e−01)	
f_{17}	9.7e+00	1.5e+01	+	9.7e+00	·	1.1e+01	+
	(2.0e+00)	(1.0e+00)		(2.0e+00)		(2.0e+00)	
f_{18}	2.9e+01	5.1e+01	+	2.9e+01	·	2.9e+01	·
	(4.1e+00)	(5.7e+00)		(4.5e+00)		(4.6e+00)	
f_{19}	5.2e−01	1.5e+00	+	5.0e−01	·	5.8e−01	·
	(1.4e−01)	(3.3e−01)		(1.3e−01)		(1.2e−01)	
f_{20}	2.7e+00	3.2e+00	+	2.9e+00	·	2.7e+00	·
	(4.1e−01)	(2.2e−01)		(3.6e−01)		(3.9e−01)	
f_{21}	3.7e+02	3.0e+02	−	3.8e+02	·	3.7e+02	·
	(7.9e+01)	(3.2e+01)		(5.6e+01)		(6.6e+01)	
f_{22}	1.1e+02	1.5e+02	+	1.1e+02	·	1.6e+02	+
	(7.9e+01)	(3.5e+01)		(7.9e+01)		(7.8e+01)	
f_{23}	9.9e+02	1.3e+03	+	9.5e+02	·	1.0e+03	·
	(2.5e+02)	(1.8e+02)		(1.8e+02)		(2.3e+02)	
f_{24}	2.0e+02	1.9e+02	·	2.1e+02	·	2.1e+02	·
	(1.3e+01)	(2.2e+01)		(9.6e+00)		(1.2e+01)	
f_{25}	2.0e+02	2.1e+02	+	2.0e+02	·	2.1e+02	+
	(1.0e+01)	(8.6e+00)		(1.5e+01)		(1.1e+01)	
f_{26}	1.6e+02	1.4e+02	·	1.7e+02	·	1.7e+02	+
	(4.3e+01)	(8.7e+00)		(4.3e+01)		(4.0e+01)	
f_{27}	3.6e+02	4.3e+02	+	3.5e+02	·	3.6e+02	+
	(9.1e+01)	(2.1e+01)		(8.2e+01)		(8.7e+01)	
f_{28}	2.8e+02	3.6e+02	+	2.9e+02	·	2.8e+02	·
	(5.4e+01)	(4.8e+01)		(5.0e+01)		(5.4e+01)	
Summary (+/·/−)		23/4/1		0/28/0		9/19/0	

Table 50: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	7.7e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(3.9e+01)		(0.0e+00)		(0.0e+00)	
f_2	1.1e+06	2.1e+06	+	1.1e+06	·	1.1e+06	·
	(5.3e+05)	(8.6e+05)		(5.0e+05)		(4.3e+05)	
f_3	2.9e+05	3.4e+08	+	6.8e+04	−	2.3e+06	+
	(4.6e+05)	(2.7e+08)		(3.0e+05)		(1.9e+06)	
f_4	7.0e+03	9.8e+03	+	6.5e+03	·	6.2e+03	·
	(2.6e+03)	(3.2e+03)		(2.2e+03)		(2.7e+03)	
f_5	0.0e+00	3.7e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(3.4e+01)		(0.0e+00)		(0.0e+00)	
f_6	6.8e+00	2.3e+01	+	6.6e+00	·	6.0e+00	·
	(4.2e+00)	(8.6e+00)		(4.3e+00)		(4.3e+00)	
f_7	4.5e+00	2.1e+01	+	2.6e+00	−	6.0e+00	·
	(1.9e+00)	(8.4e+00)		(2.5e+00)		(1.6e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(7.4e−02)	(6.9e−02)		(8.0e−02)		(6.4e−02)	
f_9	5.5e+00	5.5e+00	·	5.3e+00	·	5.5e+00	·
	(8.6e−01)	(8.7e−01)		(8.0e−01)		(7.1e−01)	
f_{10}	8.3e−01	1.2e+01	+	6.7e−01	−	9.8e−01	+
	(1.3e−01)	(6.3e+00)		(1.3e−01)		(1.3e−01)	
f_{11}	0.0e+00	1.5e+01	+	6.6e−01	+	1.0e−01	+
	(0.0e+00)	(4.7e+00)		(7.6e−01)		(1.8e−01)	
f_{12}	1.8e+01	2.1e+01	·	1.7e+01	·	1.8e+01	·
	(3.7e+00)	(4.3e+00)		(3.8e+00)		(3.5e+00)	
f_{13}	1.9e+01	2.2e+01	+	1.7e+01	·	1.8e+01	·
	(3.7e+00)	(4.7e+00)		(4.2e+00)		(4.2e+00)	
f_{14}	6.2e−01	1.4e+02	+	1.7e+01	+	6.9e+01	+
	(1.0e+00)	(6.8e+01)		(2.2e+01)		(1.7e+01)	
f_{15}	1.1e+03	1.2e+03	·	1.1e+03	·	1.1e+03	·
	(1.5e+02)	(1.6e+02)		(1.8e+02)		(1.8e+02)	
f_{16}	1.1e+00	1.1e+00	·	1.1e+00	·	1.1e+00	·
	(2.1e−01)	(2.1e−01)		(2.0e−01)		(2.2e−01)	
f_{17}	9.0e+00	3.4e+01	+	1.0e+01	+	1.2e+01	+
	(3.2e+00)	(6.7e+00)		(1.5e+00)		(1.5e+00)	
f_{18}	3.4e+01	3.6e+01	·	3.5e+01	·	3.5e+01	·
	(4.4e+00)	(5.4e+00)		(3.6e+00)		(3.9e+00)	
f_{19}	6.6e−01	3.1e+00	+	6.1e−01	·	6.6e−01	·
	(1.0e−01)	(1.0e+00)		(1.0e−01)		(1.1e−01)	
f_{20}	2.8e+00	3.2e+00	+	2.8e+00	·	2.9e+00	·
	(2.7e−01)	(2.4e−01)		(3.1e−01)		(3.1e−01)	
f_{21}	3.9e+02	4.0e+02	+	3.7e+02	·	3.9e+02	·
	(5.7e+01)	(1.5e+01)		(7.2e+01)		(4.0e+01)	
f_{22}	1.3e+02	2.9e+02	+	9.4e+01	·	1.7e+02	·
	(6.6e+01)	(9.2e+01)		(6.9e+01)		(6.2e+01)	
f_{23}	1.2e+03	1.3e+03	·	1.2e+03	·	1.2e+03	·
	(2.0e+02)	(1.7e+02)		(2.0e+02)		(1.9e+02)	
f_{24}	2.0e+02	2.0e+02	·	2.0e+02	·	2.1e+02	·
	(1.7e+01)	(2.0e+01)		(1.4e+01)		(1.8e+01)	
f_{25}	2.1e+02	2.1e+02	+	2.0e+02	·	2.1e+02	·
	(1.3e+01)	(4.9e+00)		(1.3e+01)		(1.3e+01)	
f_{26}	1.7e+02	1.3e+02	−	1.7e+02	·	1.6e+02	·
	(3.7e+01)	(8.9e+00)		(3.8e+01)		(3.7e+01)	
f_{27}	3.4e+02	4.5e+02	+	3.4e+02	·	3.7e+02	+
	(7.0e+01)	(3.0e+01)		(8.2e+01)		(6.8e+01)	
f_{28}	2.8e+02	5.2e+02	+	2.8e+02	·	2.9e+02	+
	(6.0e+01)	(5.2e+01)		(6.0e+01)		(5.1e+01)	
Summary (+/·/−)		19/8/1		3/22/3		7/21/0	

Table 51: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	8.4e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(5.5e+01)		(0.0e+00)		(0.0e+00)	
f_2	1.3e+06	2.1e+06	+	1.0e+06	·	1.6e+06	·
	(5.0e+05)	(1.1e+06)		(4.5e+05)		(6.0e+05)	
f_3	6.4e+05	3.3e+08	+	2.0e+04	−	1.7e+06	+
	(5.4e+05)	(1.7e+08)		(6.9e+04)		(1.5e+06)	
f_4	7.8e+03	1.1e+04	+	6.3e+03	−	9.0e+03	·
	(2.4e+03)	(3.0e+03)		(2.1e+03)		(2.0e+03)	
f_5	0.0e+00	3.6e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(2.6e+01)		(0.0e+00)		(0.0e+00)	
f_6	6.8e+00	2.6e+01	+	5.9e+00	·	9.4e+00	·
	(3.9e+00)	(9.6e+00)		(4.4e+00)		(1.5e+00)	
f_7	1.0e+01	2.1e+01	+	3.0e+00	−	7.8e+00	−
	(3.0e+00)	(6.1e+00)		(2.2e+00)		(3.0e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(8.2e−02)	(6.7e−02)		(7.5e−02)		(7.5e−02)	
f_9	5.4e+00	5.6e+00	·	5.3e+00	·	5.6e+00	·
	(5.5e−01)	(8.6e−01)		(8.9e−01)		(5.1e−01)	
f_{10}	4.5e−01	1.3e+01	+	6.9e−01	+	7.6e−01	+
	(8.1e−02)	(7.6e+00)		(1.2e−01)		(1.5e−01)	
f_{11}	0.0e+00	1.6e+01	+	4.7e−01	·	0.0e+00	·
	(0.0e+00)	(5.0e+00)		(6.1e−01)		(0.0e+00)	
f_{12}	1.6e+01	2.1e+01	+	1.7e+01	·	1.5e+01	·
	(3.0e+00)	(4.2e+00)		(3.3e+00)		(2.9e+00)	
f_{13}	1.7e+01	2.0e+01	·	1.9e+01	·	1.6e+01	·
	(3.4e+00)	(4.4e+00)		(4.5e+00)		(3.1e+00)	
f_{14}	1.9e+01	1.4e+02	+	1.9e+01	−	5.1e+01	+
	(7.3e+00)	(8.1e+01)		(2.7e+01)		(1.1e+01)	
f_{15}	1.0e+03	1.2e+03	+	1.1e+03	+	1.1e+03	·
	(1.6e+02)	(1.5e+02)		(1.7e+02)		(1.6e+02)	
f_{16}	1.0e+00	1.1e+00	·	1.1e+00	·	1.1e+00	·
	(1.7e−01)	(2.4e−01)		(2.0e−01)		(1.8e−01)	
f_{17}	1.0e+01	3.5e+01	+	1.0e+01	+	1.1e+01	+
	(1.8e−15)	(6.8e+00)		(2.3e+00)		(2.5e−01)	
f_{18}	3.1e+01	3.7e+01	+	3.5e+01	+	3.0e+01	·
	(3.7e+00)	(4.8e+00)		(4.2e+00)		(3.4e+00)	
f_{19}	5.3e−01	3.0e+00	+	6.3e−01	+	5.7e−01	·
	(7.1e−02)	(9.8e−01)		(9.7e−02)		(7.6e−02)	
f_{20}	3.0e+00	3.1e+00	·	2.8e+00	−	3.1e+00	·
	(2.4e−01)	(2.4e−01)		(2.6e−01)		(2.1e−01)	
f_{21}	4.0e+02	4.1e+02	+	3.6e+02	·	4.0e+02	·
	(1.2e+01)	(1.0e+01)		(8.7e+01)		(2.0e−03)	
f_{22}	1.3e+02	2.6e+02	+	8.0e+01	−	1.6e+02	+
	(3.6e+01)	(8.7e+01)		(5.9e+01)		(3.9e+01)	
f_{23}	1.3e+03	1.3e+03	·	1.1e+03	·	1.3e+03	·
	(1.7e+02)	(1.8e+02)		(1.9e+02)		(1.4e+02)	
f_{24}	1.4e+02	2.0e+02	+	2.0e+02	+	2.0e+02	+
	(8.4e+00)	(2.0e+01)		(1.3e+01)		(1.6e+01)	
f_{25}	1.9e+02	2.1e+02	+	2.0e+02	·	2.1e+02	+
	(1.8e+01)	(2.5e+00)		(1.3e+01)		(2.8e+00)	
f_{26}	1.3e+02	1.3e+02	·	1.7e+02	+	1.3e+02	·
	(6.1e+00)	(1.2e+01)		(3.9e+01)		(7.1e+00)	
f_{27}	3.1e+02	4.3e+02	+	3.4e+02	−	3.2e+02	+
	(3.0e+00)	(3.2e+01)		(8.1e+01)		(1.4e+01)	
f_{28}	2.9e+02	5.2e+02	+	3.0e+02	−	3.0e+02	·
	(3.8e+01)	(5.1e+01)		(2.8e+01)		(6.9e+00)	
Summary (+/·/−)		21/7/0		7/13/8		8/19/1	

Table 52: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	4.4e−01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(2.0e−01)		(0.0e+00)		(0.0e+00)	
f_2	4.4e+05	1.8e+06	+	7.9e+05	+	8.7e+05	+
	(1.8e+05)	(8.8e+05)		(4.6e+05)		(4.4e+05)	
f_3	2.7e+05	2.3e+07	+	3.5e+04	·	4.3e+05	+
	(1.8e+06)	(8.8e+06)		(1.3e+05)		(3.6e+05)	
f_4	5.0e+03	1.0e+04	+	5.8e+03	·	4.9e+03	·
	(1.8e+03)	(3.2e+03)		(2.0e+03)		(1.7e+03)	
f_5	0.0e+00	5.3e−01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.9e−01)		(0.0e+00)		(0.0e+00)	
f_6	5.2e+00	7.4e+00	·	7.4e+00	·	6.6e+00	·
	(4.7e+00)	(2.5e+00)		(4.5e+00)		(4.2e+00)	
f_7	1.7e+00	1.4e+01	+	1.2e+00	·	3.7e+00	+
	(8.3e−01)	(3.2e+00)		(1.2e+00)		(1.9e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(7.9e−02)	(6.2e−02)		(7.5e−02)		(6.9e−02)	
f_9	4.7e+00	5.8e+00	+	4.6e+00	·	5.2e+00	+
	(7.1e−01)	(6.2e−01)		(1.2e+00)		(7.7e−01)	
f_{10}	3.0e−01	4.4e+00	+	4.7e−01	+	6.8e−01	+
	(6.3e−02)	(1.4e+00)		(1.3e−01)		(1.4e−01)	
f_{11}	0.0e+00	1.2e+00	+	2.7e−01	·	0.0e+00	·
	(0.0e+00)	(5.3e−01)		(4.5e−01)		(0.0e+00)	
f_{12}	1.2e+01	2.3e+01	+	1.6e+01	+	1.4e+01	+
	(2.5e+00)	(3.6e+00)		(3.4e+00)		(2.6e+00)	
f_{13}	1.2e+01	2.4e+01	+	1.5e+01	+	1.4e+01	·
	(3.0e+00)	(3.6e+00)		(4.5e+00)		(2.9e+00)	
f_{14}	5.9e−01	2.1e+01	+	1.5e+01	+	5.2e+01	+
	(1.0e+00)	(6.6e+00)		(1.9e+01)		(2.7e+01)	
f_{15}	9.8e+02	1.2e+03	+	1.1e+03	+	1.1e+03	·
	(1.6e+02)	(1.4e+02)		(1.8e+02)		(1.6e+02)	
f_{16}	1.1e+00	1.1e+00	·	1.1e+00	·	1.1e+00	·
	(2.1e−01)	(1.9e−01)		(1.7e−01)		(2.0e−01)	
f_{17}	1.0e+01	1.3e+01	+	1.0e+01	+	1.1e+01	+
	(1.4e−14)	(5.0e−01)		(2.3e+00)		(1.7e+00)	
f_{18}	3.0e+01	4.3e+01	+	3.3e+01	·	3.2e+01	·
	(2.9e+00)	(4.7e+00)		(4.6e+00)		(3.5e+00)	
f_{19}	5.6e−01	1.1e+00	+	5.7e−01	·	6.2e−01	·
	(8.1e−02)	(1.7e−01)		(1.4e−01)		(9.1e−02)	
f_{20}	2.7e+00	3.1e+00	+	2.8e+00	·	2.7e+00	·
	(3.2e−01)	(2.1e−01)		(3.4e−01)		(3.5e−01)	
f_{21}	3.8e+02	3.6e+02	·	3.8e+02	·	3.9e+02	·
	(6.5e+01)	(4.7e+01)		(7.4e+01)		(4.0e+01)	
f_{22}	8.5e+01	1.1e+02	·	9.8e+01	·	1.5e+02	+
	(6.2e+01)	(3.5e+01)		(7.1e+01)		(7.0e+01)	
f_{23}	1.1e+03	1.3e+03	+	1.1e+03	·	1.1e+03	·
	(1.8e+02)	(2.0e+02)		(2.5e+02)		(2.3e+02)	
f_{24}	1.5e+02	1.9e+02	+	2.0e+02	+	2.1e+02	+
	(3.0e+01)	(2.1e+01)		(1.1e+01)		(9.1e+00)	
f_{25}	1.9e+02	2.1e+02	+	2.0e+02	·	2.1e+02	+
	(2.3e+01)	(5.5e+00)		(4.6e+00)		(7.6e+00)	
f_{26}	1.2e+02	1.4e+02	+	1.7e+02	+	1.7e+02	+
	(9.5e+00)	(1.0e+01)		(4.2e+01)		(3.8e+01)	
f_{27}	3.0e+02	3.9e+02	+	3.3e+02	−	3.2e+02	+
	(9.1e−01)	(1.6e+01)		(7.3e+01)		(4.7e+01)	
f_{28}	2.8e+02	3.2e+02	+	2.9e+02	·	2.8e+02	·
	(6.0e+01)	(1.9e+01)		(4.8e+01)		(5.7e+01)	
Summary (+/·/−)		23/5/0		9/18/1		13/15/0	

Table 53: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	1.9e+06	1.9e+06	·	1.3e+06	·	1.7e+06	·
	(7.7e+05)	(7.8e+05)		(6.1e+05)		(6.8e+05)	
f_3	3.0e+05	2.7e+05	·	1.6e+05	−	5.4e+06	+
	(3.1e+05)	(3.3e+05)		(3.0e+05)		(3.3e+06)	
f_4	9.4e+03	9.3e+03	·	7.0e+03	·	9.3e+03	·
	(3.2e+03)	(3.0e+03)		(2.2e+03)		(2.6e+03)	
f_5	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_6	9.3e+00	9.5e+00	·	5.1e+00	−	7.7e+00	·
	(1.4e+00)	(1.4e+00)		(4.2e+00)		(2.5e+00)	
f_7	7.2e+00	6.6e+00	·	5.4e+00	−	1.2e+01	+
	(2.2e+00)	(2.2e+00)		(2.3e+00)		(3.1e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(6.4e−02)	(7.5e−02)		(6.2e−02)		(7.9e−02)	
f_9	6.1e+00	6.0e+00	·	5.5e+00	−	5.9e+00	·
	(5.8e−01)	(4.8e−01)		(6.6e−01)		(6.0e−01)	
f_{10}	1.0e+00	1.0e+00	·	1.0e+00	·	1.2e+00	+
	(1.5e−01)	(9.4e−02)		(1.1e−01)		(1.2e−01)	
f_{11}	0.0e+00	0.0e+00	·	1.2e−01	·	7.8e−01	+
	(0.0e+00)	(0.0e+00)		(3.8e−01)		(3.2e−01)	
f_{12}	1.9e+01	1.9e+01	·	2.1e+01	·	1.9e+01	·
	(3.6e+00)	(3.6e+00)		(3.8e+00)		(3.2e+00)	
f_{13}	2.0e+01	2.0e+01	·	2.1e+01	·	2.0e+01	·
	(3.6e+00)	(4.1e+00)		(4.2e+00)		(2.9e+00)	
f_{14}	2.6e−01	3.1e−02	−	1.1e+01	+	7.3e+01	+
	(8.7e−02)	(4.7e−02)		(9.6e+00)		(2.2e+01)	
f_{15}	1.2e+03	1.2e+03	·	1.2e+03	·	1.2e+03	·
	(1.2e+02)	(1.6e+02)		(1.6e+02)		(1.4e+02)	
f_{16}	1.1e+00	1.1e+00	·	1.1e+00	·	1.1e+00	·
	(1.7e−01)	(2.2e−01)		(1.9e−01)		(1.6e−01)	
f_{17}	1.0e+01	1.0e+01	+	1.0e+01	+	1.2e+01	+
	(1.2e−09)	(4.6e−03)		(2.0e+00)		(3.1e−01)	
f_{18}	3.5e+01	3.4e+01	·	3.8e+01	·	3.4e+01	·
	(3.8e+00)	(4.0e+00)		(3.2e+00)		(3.8e+00)	
f_{19}	6.3e−01	6.4e−01	·	6.8e−01	·	6.6e−01	·
	(1.1e−01)	(8.0e−02)		(1.3e−01)		(1.0e−01)	
f_{20}	3.2e+00	3.2e+00	·	2.9e+00	−	3.2e+00	·
	(2.6e−01)	(2.3e−01)		(2.7e−01)		(1.8e−01)	
f_{21}	3.9e+02	3.8e+02	·	3.6e+02	·	4.0e+02	·
	(3.7e+01)	(3.9e+01)		(8.2e+01)		(5.3e−03)	
f_{22}	1.2e+02	7.6e+01	−	8.0e+01	−	1.9e+02	+
	(2.8e+01)	(3.0e+01)		(6.4e+01)		(4.7e+01)	
f_{23}	1.3e+03	1.3e+03	·	1.2e+03	·	1.3e+03	·
	(1.8e+02)	(1.8e+02)		(1.7e+02)		(1.6e+02)	
f_{24}	1.9e+02	1.9e+02	·	2.0e+02	·	2.0e+02	·
	(1.8e+01)	(1.9e+01)		(2.4e+01)		(1.7e+01)	
f_{25}	2.1e+02	2.1e+02	·	2.0e+02	·	2.1e+02	·
	(1.2e+01)	(6.2e+00)		(1.7e+01)		(7.6e+00)	
f_{26}	1.4e+02	1.4e+02	·	1.5e+02	·	1.4e+02	·
	(1.1e+01)	(8.4e+00)		(2.9e+01)		(7.4e+00)	
f_{27}	3.3e+02	3.4e+02	·	3.1e+02	−	3.8e+02	+
	(3.2e+01)	(4.3e+01)		(3.2e+01)		(1.8e+01)	
f_{28}	3.0e+02	3.0e+02	·	2.8e+02	·	3.1e+02	+
	(0.0e+00)	(0.0e+00)		(5.4e+01)		(1.0e+01)	
Summary (+/·/−)		1/25/2		2/19/7		9/19/0	

Table 54: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	2.6e−02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.4e−02)		(0.0e+00)		(0.0e+00)	
f_2	5.9e+05	1.9e+06	+	9.9e+05	+	1.0e+06	+
	(3.1e+05)	(8.8e+05)		(4.6e+05)		(4.8e+05)	
f_3	3.4e+03	2.9e+06	+	4.0e+04	·	1.5e+06	+
	(2.5e+03)	(2.9e+06)		(1.6e+05)		(1.3e+06)	
f_4	5.3e+03	1.0e+04	+	6.1e+03	·	5.5e+03	·
	(1.5e+03)	(3.2e+03)		(2.1e+03)		(1.8e+03)	
f_5	0.0e+00	6.3e−02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(2.7e−02)		(0.0e+00)		(0.0e+00)	
f_6	6.4e+00	9.0e+00	+	7.1e+00	·	5.3e+00	·
	(4.5e+00)	(2.0e+00)		(4.1e+00)		(4.2e+00)	
f_7	1.7e+00	6.8e+00	+	1.7e+00	·	4.7e+00	+
	(7.9e−01)	(3.1e+00)		(9.8e−01)		(1.4e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(7.5e−02)	(6.7e−02)		(7.0e−02)		(7.2e−02)	
f_9	5.1e+00	5.4e+00	·	5.0e+00	·	5.4e+00	·
	(5.3e−01)	(6.3e−01)		(9.5e−01)		(6.8e−01)	
f_{10}	3.1e−01	1.8e+00	+	6.0e−01	+	9.0e−01	+
	(6.8e−02)	(4.5e−01)		(1.4e−01)		(1.3e−01)	
f_{11}	0.0e+00	1.6e−01	+	5.5e−01	·	8.2e−05	·
	(0.0e+00)	(5.6e−02)		(7.8e−01)		(2.7e−04)	
f_{12}	1.2e+01	1.7e+01	+	1.6e+01	+	1.7e+01	+
	(2.6e+00)	(4.1e+00)		(3.8e+00)		(3.4e+00)	
f_{13}	1.3e+01	1.7e+01	+	1.6e+01	+	1.7e+01	+
	(3.0e+00)	(3.4e+00)		(4.2e+00)		(4.2e+00)	
f_{14}	2.0e+00	7.9e+00	+	1.5e+01	+	6.4e+01	+
	(2.1e+00)	(3.1e+00)		(3.3e+01)		(1.5e+01)	
f_{15}	1.0e+03	1.1e+03	·	1.1e+03	·	1.1e+03	·
	(1.5e+02)	(1.5e+02)		(1.9e+02)		(1.9e+02)	
f_{16}	1.1e+00	1.1e+00	·	1.1e+00	·	1.1e+00	·
	(2.0e−01)	(2.3e−01)		(2.0e−01)		(1.8e−01)	
f_{17}	1.0e+01	1.1e+01	+	9.9e+00	+	1.2e+01	+
	(1.7e−14)	(2.6e−01)		(2.4e+00)		(1.3e+00)	
f_{18}	3.0e+01	3.5e+01	+	3.5e+01	+	3.5e+01	+
	(3.1e+00)	(4.0e+00)		(3.8e+00)		(3.9e+00)	
f_{19}	5.7e−01	6.8e−01	+	5.9e−01	·	6.3e−01	·
	(9.5e−02)	(1.3e−01)		(1.2e−01)		(1.3e−01)	
f_{20}	2.7e+00	3.1e+00	+	2.8e+00	·	2.9e+00	·
	(2.9e−01)	(2.5e−01)		(3.2e−01)		(2.8e−01)	
f_{21}	4.0e+02	3.8e+02	+	3.7e+02	·	3.8e+02	·
	(0.0e+00)	(4.1e+01)		(7.6e+01)		(6.0e+01)	
f_{22}	7.9e+01	8.7e+01	·	9.9e+01	·	1.6e+02	+
	(4.7e+01)	(3.5e+01)		(6.5e+01)		(5.4e+01)	
f_{23}	1.1e+03	1.2e+03	·	1.1e+03	·	1.1e+03	·
	(1.9e+02)	(1.7e+02)		(2.0e+02)		(1.9e+02)	
f_{24}	1.5e+02	2.0e+02	+	2.0e+02	+	2.0e+02	+
	(2.7e+01)	(2.2e+01)		(1.9e+01)		(2.4e+01)	
f_{25}	1.9e+02	2.1e+02	+	2.0e+02	·	2.1e+02	+
	(1.9e+01)	(7.5e+00)		(1.4e+01)		(1.4e+01)	
f_{26}	1.2e+02	1.3e+02	+	1.6e+02	+	1.7e+02	+
	(8.2e+00)	(1.0e+01)		(3.9e+01)		(3.8e+01)	
f_{27}	3.0e+02	3.4e+02	+	3.2e+02	−	3.5e+02	+
	(3.1e−01)	(8.4e+00)		(6.0e+01)		(6.1e+01)	
f_{28}	2.8e+02	3.0e+02	+	2.7e+02	·	2.6e+02	·
	(5.3e+01)	(2.1e+01)		(7.0e+01)		(8.2e+01)	
Summary (+/·/−)		22/6/0		9/18/1		14/14/0	

Table 55: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	1.6e+06	1.7e+06	·	1.0e+06	−	1.5e+06	·
	(6.6e+05)	(6.5e+05)		(4.7e+05)		(4.5e+05)	
f_3	4.5e+02	4.8e+02	·	1.5e+04	·	2.9e+04	+
	(3.7e+02)	(4.2e+02)		(1.0e+05)		(3.1e+04)	
f_4	9.6e+03	9.4e+03	·	6.0e+03	−	8.3e+03	·
	(2.6e+03)	(2.6e+03)		(1.8e+03)		(2.4e+03)	
f_5	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_6	9.7e+00	9.7e+00	·	5.7e+00	−	9.5e+00	·
	(1.1e+00)	(1.1e+00)		(4.8e+00)		(1.6e+00)	
f_7	8.2e−02	8.0e−02	·	3.2e−01	·	2.4e+00	+
	(4.3e−02)	(3.7e−02)		(5.5e−01)		(1.1e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(6.2e−02)	(5.8e−02)		(5.9e−02)		(7.3e−02)	
f_9	6.9e+00	7.0e+00	·	3.1e+00	−	7.1e+00	·
	(6.8e−01)	(6.5e−01)		(2.2e+00)		(7.0e−01)	
f_{10}	4.8e−01	4.6e−01	·	5.4e−01	·	5.3e−01	·
	(9.1e−02)	(9.4e−02)		(1.3e−01)		(8.8e−02)	
f_{11}	0.0e+00	0.0e+00	·	1.1e+00	+	6.4e+00	+
	(0.0e+00)	(0.0e+00)		(1.0e+00)		(1.2e+00)	
f_{12}	2.5e+01	2.4e+01	·	2.5e+01	·	2.4e+01	·
	(4.5e+00)	(3.6e+00)		(6.0e+00)		(4.2e+00)	
f_{13}	2.5e+01	2.3e+01	·	2.4e+01	·	2.5e+01	·
	(4.4e+00)	(4.2e+00)		(5.9e+00)		(3.6e+00)	
f_{14}	1.6e+01	1.7e+01	·	4.8e+01	+	3.2e+02	+
	(5.8e+00)	(6.4e+00)		(5.3e+01)		(7.8e+01)	
f_{15}	1.4e+03	1.4e+03	·	1.3e+03	·	1.4e+03	·
	(1.3e+02)	(1.4e+02)		(1.6e+02)		(1.5e+02)	
f_{16}	1.2e+00	1.1e+00	·	1.1e+00	·	1.1e+00	·
	(2.0e−01)	(2.3e−01)		(1.9e−01)		(1.8e−01)	
f_{17}	1.0e+01	1.0e+01	·	1.1e+01	+	1.7e+01	+
	(4.7e−02)	(4.4e−02)		(2.8e+00)		(8.9e−01)	
f_{18}	3.7e+01	3.6e+01	·	4.1e+01	+	3.6e+01	·
	(3.9e+00)	(3.9e+00)		(5.2e+00)		(3.8e+00)	
f_{19}	1.1e+00	1.1e+00	·	5.5e−01	−	1.2e+00	·
	(1.7e−01)	(1.6e−01)		(1.7e−01)		(1.5e−01)	
f_{20}	3.1e+00	3.1e+00	·	2.9e+00	·	3.1e+00	·
	(2.1e−01)	(1.9e−01)		(3.0e−01)		(2.1e−01)	
f_{21}	4.0e+02	4.0e+02	·	3.8e+02	·	4.0e+02	·
	(2.8e+01)	(3.3e+00)		(6.0e+01)		(0.0e+00)	
f_{22}	1.5e+02	1.7e+02	·	1.4e+02	·	5.5e+02	+
	(6.9e+01)	(7.6e+01)		(7.7e+01)		(9.1e+01)	
f_{23}	1.4e+03	1.4e+03	·	1.3e+03	·	1.4e+03	·
	(1.7e+02)	(1.6e+02)		(2.0e+02)		(2.0e+02)	
f_{24}	2.1e+02	2.0e+02	·	2.0e+02	·	2.1e+02	+
	(5.2e+00)	(6.9e+00)		(1.4e+01)		(3.9e+00)	
f_{25}	2.0e+02	2.0e+02	·	2.0e+02	·	2.1e+02	+
	(3.3e+00)	(4.8e+00)		(1.2e+01)		(3.0e+00)	
f_{26}	1.4e+02	1.4e+02	·	1.7e+02	·	1.5e+02	·
	(1.9e+01)	(2.0e+01)		(3.7e+01)		(2.3e+01)	
f_{27}	3.0e+02	3.0e+02	·	3.4e+02	+	3.1e+02	+
	(1.1e−01)	(1.7e+01)		(8.0e+01)		(1.6e+01)	
f_{28}	3.0e+02	3.0e+02	·	2.7e+02	·	3.0e+02	+
	(0.0e+00)	(0.0e+00)		(7.3e+01)		(2.1e−13)	
Summary (+/·/−)		0/28/0		5/18/5		10/18/0	

Table 56: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	2.5e+06	2.5e+06	·	1.5e+06	−	2.3e+06	·
	(8.8e+05)	(1.1e+06)		(6.6e+05)		(8.7e+05)	
f_3	5.1e+04	1.6e+04	−	2.9e+04	−	1.6e+06	+
	(3.5e+04)	(1.1e+04)		(1.5e+05)		(1.3e+06)	
f_4	1.0e+04	1.0e+04	·	7.1e+03	−	9.4e+03	·
	(2.4e+03)	(2.6e+03)		(2.0e+03)		(2.6e+03)	
f_5	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_6	8.9e+00	9.1e+00	·	6.3e+00	−	5.9e+00	·
	(2.5e+00)	(2.3e+00)		(4.6e+00)		(3.9e+00)	
f_7	4.4e+00	2.6e+00	−	1.2e+00	−	8.2e+00	+
	(1.5e+00)	(1.2e+00)		(1.2e+00)		(1.9e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(7.1e−02)	(7.8e−02)		(6.2e−02)		(6.7e−02)	
f_9	7.3e+00	7.3e+00	·	4.7e+00	−	7.4e+00	·
	(6.7e−01)	(5.7e−01)		(1.8e+00)		(6.5e−01)	
f_{10}	7.6e−01	7.3e−01	·	6.7e−01	·	8.1e−01	+
	(1.1e−01)	(9.8e−02)		(1.5e−01)		(1.1e−01)	
f_{11}	3.3e+00	8.2e−07	−	0.0e+00	−	8.0e+00	+
	(8.1e−01)	(3.5e−06)		(0.0e+00)		(1.2e+00)	
f_{12}	2.8e+01	3.1e+01	·	2.8e+01	·	2.9e+01	·
	(4.1e+00)	(3.8e+00)		(6.3e+00)		(4.7e+00)	
f_{13}	2.9e+01	2.9e+01	·	2.8e+01	·	2.9e+01	·
	(4.1e+00)	(4.8e+00)		(4.9e+00)		(4.2e+00)	
f_{14}	2.7e+02	3.5e+01	−	1.6e+00	−	3.7e+02	+
	(7.2e+01)	(1.1e+01)		(2.1e+00)		(8.8e+01)	
f_{15}	1.4e+03	1.3e+03	·	1.4e+03	·	1.4e+03	·
	(1.3e+02)	(1.8e+02)		(2.0e+02)		(1.2e+02)	
f_{16}	1.2e+00	1.2e+00	·	1.1e+00	·	1.2e+00	·
	(2.1e−01)	(1.8e−01)		(1.9e−01)		(2.1e−01)	
f_{17}	1.4e+01	1.3e+01	−	9.5e+00	−	1.9e+01	+
	(6.7e−01)	(6.5e−01)		(2.4e+00)		(1.3e+00)	
f_{18}	4.1e+01	3.9e+01	·	4.3e+01	·	4.0e+01	·
	(4.7e+00)	(4.0e+00)		(4.9e+00)		(4.0e+00)	
f_{19}	1.4e+00	1.3e+00	·	5.1e−01	−	1.4e+00	·
	(1.9e−01)	(1.8e−01)		(1.4e−01)		(1.8e−01)	
f_{20}	3.2e+00	3.2e+00	·	3.0e+00	−	3.3e+00	·
	(1.7e−01)	(2.1e−01)		(3.2e−01)		(1.6e−01)	
f_{21}	3.7e+02	3.7e+02	·	3.6e+02	·	4.0e+02	·
	(5.5e+01)	(6.0e+01)		(8.0e+01)		(1.1e−06)	
f_{22}	5.3e+02	2.0e+02	−	8.1e+01	−	5.6e+02	·
	(9.6e+01)	(6.6e+01)		(7.3e+01)		(1.1e+02)	
f_{23}	1.5e+03	1.4e+03	·	1.4e+03	−	1.5e+03	·
	(1.2e+02)	(1.8e+02)		(2.4e+02)		(1.5e+02)	
f_{24}	2.1e+02	2.1e+02	−	2.0e+02	−	2.2e+02	·
	(4.8e+00)	(5.5e+00)		(1.3e+01)		(2.2e+00)	
f_{25}	2.1e+02	2.1e+02	·	2.0e+02	−	2.1e+02	·
	(3.1e+00)	(5.0e+00)		(7.7e+00)		(1.5e+00)	
f_{26}	1.5e+02	1.5e+02	·	1.7e+02	·	1.5e+02	·
	(1.2e+01)	(1.1e+01)		(3.4e+01)		(1.0e+01)	
f_{27}	3.9e+02	3.3e+02	−	3.2e+02	−	4.2e+02	·
	(6.4e+01)	(4.8e+01)		(5.7e+01)		(4.6e+01)	
f_{28}	3.0e+02	3.0e+02	−	3.0e+02	+	3.0e+02	·
	(3.5e−12)	(1.8e−12)		(2.8e+01)		(8.7e−08)	
Summary (+/·/−)		0/19/9		1/11/16		6/22/0	

Table 57: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	1.6e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(6.3e+00)		(0.0e+00)		(0.0e+00)	
f_2	9.9e+04	3.3e+06	+	9.6e+04	·	1.4e+05	·
	(8.0e+04)	(1.3e+06)		(1.2e+05)		(8.7e+04)	
f_3	6.3e+05	1.9e+08	+	1.7e+05	·	1.0e+05	·
	(2.4e+06)	(6.6e+07)		(5.2e+05)		(6.3e+05)	
f_4	1.2e+03	1.1e+04	+	1.2e+03	·	1.4e+03	·
	(6.3e+02)	(3.4e+03)		(5.8e+02)		(5.8e+02)	
f_5	0.0e+00	8.6e+00	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(2.2e+00)		(0.0e+00)		(0.0e+00)	
f_6	5.4e+00	1.5e+01	+	6.2e+00	·	5.7e+00	·
	(4.9e+00)	(2.0e+00)		(4.5e+00)		(4.8e+00)	
f_7	3.3e+00	2.6e+01	+	1.9e+00	·	1.3e+00	·
	(6.0e+00)	(4.9e+00)		(4.7e+00)		(3.7e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(6.9e−02)	(5.8e−02)		(6.7e−02)		(6.9e−02)	
f_9	2.3e+00	7.2e+00	+	2.4e+00	·	2.3e+00	·
	(1.1e+00)	(7.2e−01)		(1.2e+00)		(1.5e+00)	
f_{10}	1.4e−01	2.1e+01	+	1.2e−01	·	3.3e−01	+
	(9.2e−02)	(5.7e+00)		(7.2e−02)		(1.1e−01)	
f_{11}	2.3e+00	6.0e+00	+	2.1e+00	·	1.4e+00	·
	(2.2e+00)	(1.3e+00)		(1.2e+00)		(1.1e+00)	
f_{12}	1.1e+01	4.1e+01	+	1.1e+01	·	1.8e+01	+
	(4.1e+00)	(6.0e+00)		(5.5e+00)		(4.0e+00)	
f_{13}	1.5e+01	4.0e+01	+	1.4e+01	·	1.6e+01	·
	(7.1e+00)	(4.7e+00)		(6.3e+00)		(4.4e+00)	
f_{14}	9.9e+01	7.8e+01	·	1.1e+02	·	2.0e+02	+
	(7.5e+01)	(1.7e+01)		(9.6e+01)		(1.1e+02)	
f_{15}	1.1e+03	1.3e+03	+	1.1e+03	·	1.2e+03	·
	(3.0e+02)	(1.8e+02)		(2.5e+02)		(1.9e+02)	
f_{16}	1.1e+00	1.1e+00	·	1.1e+00	·	1.2e+00	·
	(1.8e−01)	(2.1e−01)		(1.9e−01)		(2.1e−01)	
f_{17}	9.5e+00	2.1e+01	+	9.4e+00	·	1.5e+01	+
	(2.9e+00)	(2.3e+00)		(2.8e+00)		(2.9e+00)	
f_{18}	3.1e+01	6.1e+01	+	3.1e+01	·	3.2e+01	·
	(4.5e+00)	(6.8e+00)		(5.8e+00)		(4.7e+00)	
f_{19}	4.6e−01	3.1e+00	+	4.8e−01	·	9.2e−01	+
	(1.5e−01)	(6.5e−01)		(1.4e−01)		(1.5e−01)	
f_{20}	2.9e+00	3.4e+00	+	2.7e+00	·	2.7e+00	·
	(5.4e−01)	(1.9e−01)		(5.7e−01)		(5.2e−01)	
f_{21}	3.8e+02	3.9e+02	·	3.8e+02	·	3.8e+02	·
	(5.6e+01)	(2.2e+01)		(6.3e+01)		(5.6e+01)	
f_{22}	2.0e+02	2.5e+02	·	1.7e+02	·	2.5e+02	·
	(1.2e+02)	(8.7e+01)		(1.1e+02)		(1.4e+02)	
f_{23}	9.7e+02	1.4e+03	+	9.6e+02	·	1.1e+03	·
	(3.7e+02)	(1.6e+02)		(3.8e+02)		(2.1e+02)	
f_{24}	2.0e+02	2.2e+02	+	2.1e+02	·	2.0e+02	·
	(1.5e+01)	(2.3e+00)		(1.5e+01)		(1.3e+01)	
f_{25}	2.1e+02	2.1e+02	+	2.1e+02	·	2.0e+02	·
	(1.3e+01)	(5.5e+00)		(1.4e+01)		(1.2e+01)	
f_{26}	1.6e+02	1.6e+02	·	1.7e+02	·	1.8e+02	+
	(5.4e+01)	(1.5e+01)		(6.0e+01)		(5.8e+01)	
f_{27}	3.9e+02	4.8e+02	·	3.7e+02	·	3.8e+02	·
	(9.5e+01)	(2.0e+01)		(9.5e+01)		(9.8e+01)	
f_{28}	3.1e+02	4.3e+02	+	3.1e+02	·	3.1e+02	·
	(8.3e+01)	(2.7e+01)		(8.5e+01)		(9.7e+01)	
Summary (+/·/−)		21/7/0		0/28/0		6/22/0	

Table 58: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	1.5e+02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(7.8e+01)		(0.0e+00)		(0.0e+00)	
f_2	5.4e+05	2.4e+06	+	4.6e+05	·	5.6e+05	·
	(2.7e+05)	(9.5e+05)		(2.8e+05)		(1.8e+05)	
f_3	2.8e+02	6.3e+08	+	3.7e+05	·	5.9e+04	+
	(5.7e+02)	(3.4e+08)		(2.6e+06)		(2.7e+05)	
f_4	4.0e+03	7.3e+03	+	4.4e+03	·	4.1e+03	·
	(1.1e+03)	(2.7e+03)		(1.4e+03)		(1.6e+03)	
f_5	0.0e+00	8.4e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(6.8e+01)		(0.0e+00)		(0.0e+00)	
f_6	6.9e+00	3.1e+01	+	5.8e+00	·	6.0e+00	·
	(4.4e+00)	(1.1e+01)		(4.7e+00)		(4.7e+00)	
f_7	1.7e−01	3.3e+01	+	8.8e−02	−	9.3e−01	+
	(4.4e−01)	(8.6e+00)		(1.7e−01)		(9.6e−01)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(7.5e−02)	(8.1e−02)		(8.0e−02)		(6.0e−02)	
f_9	4.0e+00	5.8e+00	+	1.7e+00	−	5.4e+00	+
	(2.2e+00)	(9.9e−01)		(1.5e+00)		(1.4e+00)	
f_{10}	5.2e−01	2.7e+01	+	4.0e−01	−	5.4e−01	·
	(9.4e−02)	(1.5e+01)		(1.3e−01)		(1.0e−01)	
f_{11}	0.0e+00	2.0e+01	+	2.5e+00	+	6.4e+00	+
	(0.0e+00)	(6.3e+00)		(1.2e+00)		(1.2e+00)	
f_{12}	2.4e+01	3.0e+01	+	2.1e+01	·	2.5e+01	·
	(4.3e+00)	(5.7e+00)		(4.9e+00)		(3.7e+00)	
f_{13}	2.4e+01	2.9e+01	+	2.0e+01	·	2.4e+01	·
	(4.7e+00)	(5.1e+00)		(6.3e+00)		(5.4e+00)	
f_{14}	1.0e+02	1.8e+02	+	6.2e+01	·	2.9e+02	+
	(6.0e+01)	(9.2e+01)		(6.8e+01)		(8.3e+01)	
f_{15}	1.3e+03	1.2e+03	·	1.3e+03	·	1.3e+03	·
	(1.8e+02)	(1.7e+02)		(1.7e+02)		(1.7e+02)	
f_{16}	1.2e+00	1.1e+00	·	1.2e+00	·	1.2e+00	·
	(1.9e−01)	(2.1e−01)		(1.9e−01)		(2.4e−01)	
f_{17}	9.9e+00	4.4e+01	+	1.1e+01	+	1.6e+01	+
	(2.0e+00)	(8.7e+00)		(2.4e+00)		(2.1e+00)	
f_{18}	3.5e+01	4.5e+01	+	3.6e+01	·	3.7e+01	·
	(4.8e+00)	(5.8e+00)		(5.0e+00)		(4.0e+00)	
f_{19}	1.1e+00	5.1e+00	+	5.4e−01	−	1.1e+00	·
	(1.7e−01)	(1.9e+00)		(1.7e−01)		(1.5e−01)	
f_{20}	2.9e+00	3.3e+00	+	2.8e+00	·	2.9e+00	·
	(3.6e−01)	(2.5e−01)		(4.1e−01)		(3.6e−01)	
f_{21}	3.6e+02	4.1e+02	+	3.6e+02	·	3.7e+02	·
	(8.5e+01)	(1.1e+01)		(8.7e+01)		(8.4e+01)	
f_{22}	1.6e+02	3.7e+02	+	1.4e+02	·	4.1e+02	+
	(9.3e+01)	(1.2e+02)		(1.1e+02)		(1.1e+02)	
f_{23}	1.3e+03	1.3e+03	·	1.3e+03	·	1.3e+03	·
	(2.2e+02)	(2.1e+02)		(2.4e+02)		(2.0e+02)	
f_{24}	2.0e+02	2.2e+02	+	2.0e+02	·	2.0e+02	·
	(4.5e+00)	(6.4e+00)		(1.1e+01)		(9.8e+00)	
f_{25}	2.0e+02	2.2e+02	+	2.0e+02	·	2.0e+02	+
	(9.8e+00)	(3.0e+00)		(1.6e+01)		(1.0e+01)	
f_{26}	1.7e+02	1.6e+02	·	1.8e+02	·	1.7e+02	·
	(3.7e+01)	(2.5e+01)		(4.9e+01)		(3.8e+01)	
f_{27}	3.6e+02	4.9e+02	+	3.7e+02	·	3.6e+02	+
	(9.3e+01)	(3.7e+01)		(9.4e+01)		(1.0e+02)	
f_{28}	3.0e+02	5.7e+02	+	2.9e+02	·	2.9e+02	·
	(2.8e+01)	(7.3e+01)		(5.7e+01)		(3.9e+01)	
Summary (+/·/−)		23/5/0		2/22/4		9/19/0	

Table 59: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	1.5e+02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(8.1e+01)		(0.0e+00)		(0.0e+00)	
f_2	4.7e+05	2.4e+06	+	4.5e+05	·	5.2e+05	·
	(2.3e+05)	(1.3e+06)		(1.8e+05)		(2.3e+05)	
f_3	1.9e+03	9.0e+08	+	2.1e+04	−	1.8e+03	−
	(2.1e+03)	(8.3e+08)		(8.9e+04)		(1.0e+04)	
f_4	5.5e+03	6.5e+03	·	4.1e+03	−	5.8e+03	·
	(1.4e+03)	(2.3e+03)		(1.5e+03)		(1.7e+03)	
f_5	1.1e−05	7.3e+01	+	0.0e+00	·	0.0e+00	·
	(7.4e−05)	(5.7e+01)		(0.0e+00)		(0.0e+00)	
f_6	9.0e+00	3.4e+01	+	6.8e+00	−	9.9e+00	·
	(2.6e+00)	(1.7e+01)		(4.6e+00)		(5.9e−02)	
f_7	5.8e−01	3.5e+01	+	1.1e−01	−	1.1e−01	−
	(4.3e−01)	(1.0e+01)		(2.2e−01)		(1.4e−01)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(6.9e−02)	(6.4e−02)		(6.5e−02)		(8.5e−02)	
f_9	6.0e+00	5.9e+00	·	1.8e+00	−	6.2e+00	·
	(6.2e−01)	(9.5e−01)		(1.7e+00)		(7.4e−01)	
f_{10}	3.3e−01	3.0e+01	+	3.4e−01	·	3.9e−01	·
	(8.0e−02)	(1.7e+01)		(1.6e−01)		(7.4e−02)	
f_{11}	0.0e+00	2.1e+01	+	2.7e+00	+	3.9e+00	+
	(0.0e+00)	(6.2e+00)		(1.3e+00)		(8.6e−01)	
f_{12}	1.8e+01	3.0e+01	+	2.0e+01	·	1.9e+01	·
	(3.6e+00)	(5.4e+00)		(5.8e+00)		(3.1e+00)	
f_{13}	1.9e+01	2.9e+01	+	1.9e+01	·	1.7e+01	·
	(3.2e+00)	(5.8e+00)		(6.6e+00)		(3.5e+00)	
f_{14}	2.4e+02	1.8e+02	−	6.3e+01	−	2.4e+02	·
	(6.8e+01)	(9.5e+01)		(6.0e+01)		(6.1e+01)	
f_{15}	1.2e+03	1.2e+03	·	1.3e+03	·	1.3e+03	·
	(1.5e+02)	(1.8e+02)		(1.7e+02)		(1.4e+02)	
f_{16}	1.1e+00	1.1e+00	·	1.2e+00	·	1.1e+00	·
	(2.4e−01)	(2.3e−01)		(1.8e−01)		(1.5e−01)	
f_{17}	1.0e+01	4.5e+01	+	1.0e+01	+	1.5e+01	+
	(1.3e−02)	(9.4e+00)		(3.0e+00)		(7.4e−01)	
f_{18}	3.2e+01	4.5e+01	+	3.6e+01	+	3.1e+01	·
	(3.1e+00)	(5.5e+00)		(4.9e+00)		(3.7e+00)	
f_{19}	9.6e−01	4.8e+00	+	5.0e−01	−	9.6e−01	·
	(1.4e−01)	(2.0e+00)		(1.6e−01)		(1.6e−01)	
f_{20}	3.0e+00	3.3e+00	+	2.8e+00	−	2.9e+00	·
	(2.2e−01)	(2.8e−01)		(4.2e−01)		(2.8e−01)	
f_{21}	4.0e+02	4.1e+02	+	3.8e+02	·	4.0e+02	·
	(0.0e+00)	(7.9e+00)		(6.0e+01)		(0.0e+00)	
f_{22}	3.9e+02	3.7e+02	·	1.5e+02	−	3.9e+02	·
	(9.8e+01)	(1.1e+02)		(1.1e+02)		(1.1e+02)	
f_{23}	1.4e+03	1.2e+03	−	1.3e+03	·	1.2e+03	−
	(1.6e+02)	(2.3e+02)		(2.5e+02)		(1.8e+02)	
f_{24}	1.5e+02	2.2e+02	+	2.0e+02	+	2.0e+02	+
	(1.2e+01)	(2.5e+00)		(1.3e+01)		(1.4e+00)	
f_{25}	2.0e+02	2.2e+02	+	2.0e+02	·	2.0e+02	−
	(7.9e+00)	(2.6e+00)		(4.5e+00)		(2.1e−01)	
f_{26}	1.3e+02	1.5e+02	+	1.7e+02	·	1.3e+02	·
	(5.5e+00)	(2.2e+01)		(4.8e+01)		(1.8e+01)	
f_{27}	3.0e+02	4.8e+02	+	3.3e+02	−	3.0e+02	−
	(2.5e−01)	(3.8e+01)		(7.5e+01)		(1.0e−01)	
f_{28}	3.0e+02	5.7e+02	+	2.9e+02	·	3.0e+02	·
	(0.0e+00)	(7.2e+01)		(4.8e+01)		(4.6e−01)	
Summary (+/·/−)		20/6/2		4/14/10		3/20/5	

Table 60: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	4.2e+00	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.7e+00)		(0.0e+00)		(0.0e+00)	
f_2	5.7e+04	2.2e+06	+	1.9e+05	+	2.2e+05	+
	(2.8e+04)	(8.7e+05)		(1.2e+05)		(1.0e+05)	
f_3	1.5e+04	4.6e+07	+	1.1e+05	·	5.7e+03	·
	(5.0e+04)	(1.7e+07)		(5.2e+05)		(2.7e+04)	
f_4	1.5e+03	1.0e+04	+	2.6e+03	+	2.2e+03	+
	(5.6e+02)	(3.4e+03)		(9.8e+02)		(8.3e+02)	
f_5	0.0e+00	3.4e+00	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(9.2e−01)		(0.0e+00)		(0.0e+00)	
f_6	4.9e+00	1.0e+01	+	6.7e+00	·	7.9e+00	+
	(4.7e+00)	(1.6e+00)		(8.5e+00)		(3.9e+00)	
f_7	7.8e−02	1.4e+01	+	9.5e−01	·	3.1e−01	·
	(1.9e−01)	(2.3e+00)		(2.6e+00)		(1.2e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(6.7e−02)	(7.0e−02)		(7.5e−02)		(5.7e−02)	
f_9	2.6e+00	6.3e+00	+	1.4e+00	−	3.9e+00	+
	(1.8e+00)	(6.4e−01)		(1.2e+00)		(1.6e+00)	
f_{10}	2.4e−01	8.5e+00	+	2.5e−01	·	4.1e−01	+
	(8.1e−02)	(3.0e+00)		(1.7e−01)		(7.3e−02)	
f_{11}	0.0e+00	3.7e+00	+	2.7e+00	+	2.7e+00	+
	(0.0e+00)	(1.1e+00)		(1.9e+00)		(1.6e+00)	
f_{12}	1.6e+01	3.1e+01	+	1.6e+01	·	1.8e+01	·
	(2.9e+00)	(4.9e+00)		(6.0e+00)		(3.9e+00)	
f_{13}	1.4e+01	3.1e+01	+	1.5e+01	·	1.7e+01	·
	(4.1e+00)	(4.9e+00)		(6.2e+00)		(3.3e+00)	
f_{14}	1.2e+02	6.4e+01	·	1.2e+02	·	2.4e+02	+
	(8.9e+01)	(2.1e+01)		(8.8e+01)		(7.5e+01)	
f_{15}	1.2e+03	1.4e+03	+	1.2e+03	·	1.3e+03	·
	(1.8e+02)	(1.3e+02)		(2.1e+02)		(1.4e+02)	
f_{16}	1.1e+00	1.1e+00	·	1.1e+00	·	1.1e+00	·
	(1.9e−01)	(1.8e−01)		(2.3e−01)		(2.2e−01)	
f_{17}	9.9e+00	1.6e+01	+	1.0e+01	+	1.5e+01	+
	(1.4e+00)	(1.3e+00)		(3.3e+00)		(2.1e+00)	
f_{18}	3.1e+01	5.0e+01	+	3.3e+01	·	3.2e+01	·
	(4.4e+00)	(4.8e+00)		(3.4e+00)		(4.6e+00)	
f_{19}	9.1e−01	2.1e+00	+	4.9e−01	−	9.9e−01	·
	(1.7e−01)	(3.5e−01)		(1.4e−01)		(1.5e−01)	
f_{20}	2.5e+00	3.2e+00	+	2.8e+00	·	2.7e+00	·
	(3.8e−01)	(2.5e−01)		(4.6e−01)		(4.5e−01)	
f_{21}	4.0e+02	4.0e+02	+	3.8e+02	·	3.9e+02	·
	(0.0e+00)	(1.5e+01)		(6.5e+01)		(4.7e+01)	
f_{22}	1.9e+02	2.0e+02	·	1.8e+02	·	3.1e+02	+
	(1.4e+02)	(6.9e+01)		(1.2e+02)		(1.3e+02)	
f_{23}	1.2e+03	1.4e+03	·	1.1e+03	·	1.2e+03	·
	(1.9e+02)	(1.6e+02)		(2.4e+02)		(2.3e+02)	
f_{24}	2.0e+02	2.1e+02	+	2.0e+02	·	2.1e+02	·
	(1.8e+01)	(7.1e+00)		(4.9e+00)		(5.4e+00)	
f_{25}	2.0e+02	2.1e+02	+	2.0e+02	·	2.0e+02	·
	(3.6e+00)	(4.2e+00)		(4.5e+00)		(5.2e+00)	
f_{26}	1.3e+02	1.5e+02	+	1.7e+02	+	1.7e+02	+
	(3.0e+01)	(2.3e+01)		(5.3e+01)		(4.0e+01)	
f_{27}	3.1e+02	4.1e+02	+	3.6e+02	·	3.5e+02	·
	(4.3e+01)	(2.0e+01)		(8.9e+01)		(8.7e+01)	
f_{28}	2.8e+02	3.6e+02	+	2.8e+02	·	2.9e+02	·
	(7.5e+01)	(1.7e+01)		(6.2e+01)		(5.0e+01)	
Summary (+/·/−)		23/5/0		5/21/2		10/18/0	

Table 61: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	1.6e+06	1.4e+06	·	1.0e+06	−	1.5e+06	·
	(4.3e+05)	(5.4e+05)		(5.0e+05)		(5.0e+05)	
f_3	5.7e+02	3.4e+02	·	2.2e+04	−	1.7e+04	+
	(5.7e+02)	(3.4e+02)		(1.4e+05)		(1.8e+04)	
f_4	8.8e+03	8.9e+03	·	6.2e+03	−	8.2e+03	·
	(2.8e+03)	(2.3e+03)		(2.1e+03)		(2.3e+03)	
f_5	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_6	9.7e+00	9.8e+00	·	5.3e+00	−	9.2e+00	·
	(1.1e+00)	(1.4e−01)		(4.9e+00)		(2.2e+00)	
f_7	7.8e−02	4.5e−02	−	2.6e−01	+	1.8e+00	+
	(5.3e−02)	(3.6e−02)		(4.9e−01)		(7.7e−01)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(2.3e−01)	(5.6e−02)		(6.5e−02)		(6.8e−02)	
f_9	6.8e+00	7.0e+00	·	3.0e+00	−	7.0e+00	·
	(6.7e−01)	(6.1e−01)		(1.7e+00)		(7.1e−01)	
f_{10}	4.8e−01	4.9e−01	·	5.5e−01	+	5.4e−01	·
	(7.4e−02)	(8.0e−02)		(1.0e−01)		(5.7e−02)	
f_{11}	0.0e+00	0.0e+00	·	1.7e+00	+	6.1e+00	+
	(0.0e+00)	(0.0e+00)		(1.0e+00)		(1.0e+00)	
f_{12}	2.5e+01	2.4e+01	·	2.6e+01	·	2.5e+01	·
	(4.2e+00)	(4.2e+00)		(5.7e+00)		(3.6e+00)	
f_{13}	2.3e+01	2.4e+01	·	2.4e+01	·	2.3e+01	·
	(4.8e+00)	(4.2e+00)		(5.3e+00)		(3.7e+00)	
f_{14}	1.3e+02	2.2e+01	−	4.4e+01	−	3.3e+02	+
	(3.1e+01)	(8.2e+00)		(4.1e+01)		(8.0e+01)	
f_{15}	1.3e+03	1.3e+03	·	1.3e+03	·	1.3e+03	·
	(1.6e+02)	(1.4e+02)		(1.6e+02)		(1.4e+02)	
f_{16}	1.2e+00	1.1e+00	·	1.1e+00	·	1.2e+00	·
	(1.8e−01)	(2.2e−01)		(2.2e−01)		(2.2e−01)	
f_{17}	1.3e+01	1.2e+01	−	1.2e+01	−	1.6e+01	+
	(5.6e−01)	(3.5e−01)		(2.3e+00)		(9.3e−01)	
f_{18}	3.5e+01	3.5e+01	·	4.1e+01	+	3.6e+01	·
	(4.3e+00)	(4.6e+00)		(4.7e+00)		(4.2e+00)	
f_{19}	1.1e+00	1.1e+00	·	5.2e−01	−	1.1e+00	·
	(1.4e−01)	(1.7e−01)		(1.7e−01)		(1.6e−01)	
f_{20}	3.0e+00	3.0e+00	·	2.9e+00	·	3.0e+00	·
	(2.3e−01)	(2.1e−01)		(3.6e−01)		(2.2e−01)	
f_{21}	4.0e+02	3.9e+02	·	3.8e+02	·	4.0e+02	·
	(7.0e+00)	(2.7e+01)		(6.5e+01)		(1.2e+00)	
f_{22}	3.7e+02	1.5e+02	−	1.2e+02	−	5.1e+02	+
	(1.1e+02)	(6.4e+01)		(8.0e+01)		(8.2e+01)	
f_{23}	1.4e+03	1.4e+03	·	1.3e+03	·	1.4e+03	·
	(1.7e+02)	(2.0e+02)		(1.8e+02)		(1.9e+02)	
f_{24}	2.0e+02	2.0e+02	·	2.0e+02	·	2.1e+02	+
	(5.1e+00)	(5.8e+00)		(1.5e+01)		(3.4e+00)	
f_{25}	2.0e+02	2.0e+02	·	2.0e+02	·	2.1e+02	+
	(4.2e+00)	(5.4e+00)		(1.4e+01)		(4.5e+00)	
f_{26}	1.4e+02	1.4e+02	·	1.7e+02	·	1.4e+02	·
	(1.7e+01)	(1.9e+01)		(3.6e+01)		(1.4e+01)	
f_{27}	3.0e+02	3.0e+02	·	3.3e+02	+	3.0e+02	+
	(7.6e−01)	(3.0e+01)		(6.7e+01)		(9.1e+00)	
f_{28}	3.0e+02	3.0e+02	·	3.0e+02	·	3.0e+02	+
	(0.0e+00)	(0.0e+00)		(2.8e+01)		(1.9e−13)	
Summary (+/·/−)		0/24/4		5/14/9		10/18/0	

Table 62: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	3.0e−01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.5e−01)		(0.0e+00)		(0.0e+00)	
f_2	8.6e+04	1.3e+06	+	3.8e+05	+	4.3e+05	+
	(4.3e+04)	(6.6e+05)		(1.8e+05)		(2.5e+05)	
f_3	4.7e+02	2.6e+06	+	7.4e+04	·	8.7e+03	+
	(3.2e+03)	(1.9e+06)		(4.0e+05)		(4.0e+04)	
f_4	1.8e+03	9.3e+03	+	3.4e+03	+	3.3e+03	+
	(6.8e+02)	(2.8e+03)		(1.1e+03)		(1.2e+03)	
f_5	0.0e+00	5.2e−01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.9e−01)		(0.0e+00)		(0.0e+00)	
f_6	7.2e+00	9.5e+00	+	7.1e+00	·	6.3e+00	·
	(4.3e+00)	(1.7e+00)		(4.3e+00)		(4.6e+00)	
f_7	9.5e−03	4.1e+00	+	5.4e−02	·	3.3e−01	+
	(3.1e−02)	(1.5e+00)		(1.5e−01)		(3.9e−01)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(6.1e−02)	(6.6e−02)		(6.7e−02)		(7.2e−02)	
f_9	3.0e+00	4.1e+00	·	1.6e+00	−	5.0e+00	+
	(1.7e+00)	(9.5e−01)		(1.4e+00)		(1.7e+00)	
f_{10}	2.8e−01	2.2e+00	+	3.2e−01	·	4.8e−01	+
	(6.6e−02)	(5.4e−01)		(1.4e−01)		(7.3e−02)	
f_{11}	0.0e+00	1.2e+00	+	2.1e+00	+	5.8e+00	+
	(0.0e+00)	(5.4e−01)		(1.4e+00)		(1.2e+00)	
f_{12}	1.6e+01	2.3e+01	+	1.8e+01	+	2.1e+01	+
	(2.6e+00)	(3.6e+00)		(5.2e+00)		(3.3e+00)	
f_{13}	1.4e+01	2.2e+01	+	1.9e+01	+	2.1e+01	+
	(3.1e+00)	(3.9e+00)		(4.2e+00)		(3.9e+00)	
f_{14}	1.2e+02	3.3e+01	−	6.0e+01	−	2.8e+02	+
	(6.1e+01)	(1.0e+01)		(7.1e+01)		(8.2e+01)	
f_{15}	1.2e+03	1.2e+03	·	1.3e+03	·	1.3e+03	·
	(1.5e+02)	(1.6e+02)		(1.6e+02)		(1.5e+02)	
f_{16}	1.1e+00	1.2e+00	·	1.2e+00	·	1.2e+00	·
	(1.7e−01)	(2.1e−01)		(1.7e−01)		(2.0e−01)	
f_{17}	1.0e+01	1.3e+01	+	1.1e+01	+	1.6e+01	+
	(8.6e−11)	(6.0e−01)		(2.2e+00)		(2.4e+00)	
f_{18}	3.1e+01	3.8e+01	+	3.5e+01	+	3.4e+01	+
	(3.1e+00)	(3.9e+00)		(4.2e+00)		(4.2e+00)	
f_{19}	9.3e−01	1.3e+00	+	4.8e−01	−	1.1e+00	+
	(1.2e−01)	(1.9e−01)		(1.3e−01)		(1.9e−01)	
f_{20}	2.6e+00	3.0e+00	+	2.8e+00	·	2.8e+00	·
	(3.3e−01)	(2.8e−01)		(4.4e−01)		(3.6e−01)	
f_{21}	4.0e+02	3.9e+02	+	3.8e+02	·	3.9e+02	·
	(0.0e+00)	(3.1e+01)		(6.5e+01)		(4.8e+01)	
f_{22}	2.0e+02	1.1e+02	−	1.7e+02	·	3.8e+02	+
	(1.1e+02)	(4.4e+01)		(1.2e+02)		(1.3e+02)	
f_{23}	1.1e+03	1.2e+03	·	1.2e+03	·	1.3e+03	·
	(2.3e+02)	(2.2e+02)		(2.2e+02)		(2.2e+02)	
f_{24}	2.0e+02	2.1e+02	+	2.1e+02	·	2.0e+02	+
	(1.5e+01)	(8.1e+00)		(4.2e+00)		(5.3e+00)	
f_{25}	2.0e+02	2.1e+02	+	2.0e+02	·	2.0e+02	+
	(8.5e+00)	(6.7e+00)		(1.0e+01)		(9.7e+00)	
f_{26}	1.3e+02	1.5e+02	+	1.7e+02	+	1.7e+02	+
	(2.5e+01)	(2.5e+01)		(5.1e+01)		(3.8e+01)	
f_{27}	3.1e+02	3.4e+02	+	3.5e+02	+	3.5e+02	+
	(3.0e+01)	(6.3e+00)		(8.5e+01)		(8.8e+01)	
f_{28}	2.9e+02	3.1e+02	+	2.9e+02	·	2.9e+02	·
	(3.9e+01)	(4.7e+00)		(5.0e+01)		(3.9e+01)	
Summary (+/·/−)		21/5/2		9/16/3		18/10/0	

Table 63: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	4.5e+04	4.9e+04	·	2.2e+04	−	4.1e+04	·
	(2.1e+04)	(2.9e+04)		(3.3e+04)		(1.7e+04)	
f_3	5.2e+00	6.7e+00	·	5.1e+03	−	6.0e+01	+
	(5.2e+00)	(1.0e+01)		(3.6e+04)		(9.8e+01)	
f_4	7.4e+02	8.5e+02	·	3.5e+02	−	6.5e+02	·
	(2.6e+02)	(3.3e+02)		(2.6e+02)		(2.1e+02)	
f_5	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_6	9.1e+00	8.0e+00	·	4.1e+00	−	7.1e+00	·
	(2.6e+00)	(3.7e+00)		(4.8e+00)		(4.3e+00)	
f_7	2.4e−03	2.7e−03	·	6.0e−01	·	9.7e−02	+
	(1.4e−03)	(1.7e−03)		(1.8e+00)		(4.1e−02)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(8.9e−02)	(6.8e−02)		(8.8e−02)		(7.4e−02)	
f_9	5.3e+00	4.1e+00	·	2.0e+00	−	7.7e+00	+
	(2.4e+00)	(2.8e+00)		(1.8e+00)		(6.8e−01)	
f_{10}	4.7e−01	4.8e−01	·	2.0e−01	−	5.2e−01	·
	(8.0e−02)	(8.6e−02)		(1.2e−01)		(8.1e−02)	
f_{11}	2.7e−05	3.6e−06	·	4.4e+00	+	1.3e+01	+
	(1.2e−04)	(1.6e−05)		(2.6e+00)		(2.0e+00)	
f_{12}	2.6e+01	2.6e+01	·	1.5e+01	−	2.6e+01	·
	(4.5e+00)	(3.7e+00)		(6.1e+00)		(3.6e+00)	
f_{13}	2.6e+01	2.6e+01	·	2.2e+01	·	2.6e+01	·
	(4.4e+00)	(3.7e+00)		(7.6e+00)		(4.0e+00)	
f_{14}	5.6e+01	5.5e+01	·	1.4e+02	·	7.1e+02	+
	(1.5e+01)	(1.8e+01)		(1.1e+02)		(1.4e+02)	
f_{15}	1.3e+03	1.4e+03	·	1.0e+03	−	1.3e+03	·
	(1.3e+02)	(1.4e+02)		(3.0e+02)		(1.6e+02)	
f_{16}	1.1e+00	1.1e+00	·	1.1e+00	·	1.1e+00	·
	(1.9e−01)	(1.8e−01)		(2.2e−01)		(2.2e−01)	
f_{17}	1.2e+01	1.2e+01	·	1.5e+01	+	2.4e+01	+
	(3.8e−01)	(4.7e−01)		(3.7e+00)		(2.2e+00)	
f_{18}	3.6e+01	3.6e+01	·	3.4e+01	·	3.6e+01	·
	(4.0e+00)	(3.8e+00)		(8.1e+00)		(3.9e+00)	
f_{19}	1.5e+00	1.5e+00	·	8.1e−01	−	1.8e+00	+
	(2.1e−01)	(2.1e−01)		(2.7e−01)		(2.4e−01)	
f_{20}	2.8e+00	2.8e+00	·	2.6e+00	·	2.9e+00	·
	(2.0e−01)	(2.6e−01)		(4.8e−01)		(2.0e−01)	
f_{21}	3.9e+02	4.0e+02	·	3.7e+02	·	4.0e+02	·
	(5.7e+01)	(0.0e+00)		(7.9e+01)		(0.0e+00)	
f_{22}	1.7e+02	1.5e+02	·	2.2e+02	·	9.2e+02	+
	(7.8e+01)	(7.8e+01)		(1.4e+02)		(1.3e+02)	
f_{23}	1.3e+03	1.4e+03	·	9.6e+02	−	1.4e+03	·
	(1.6e+02)	(1.8e+02)		(3.1e+02)		(1.7e+02)	
f_{24}	2.0e+02	2.0e+02	·	2.1e+02	·	2.0e+02	·
	(1.3e+01)	(1.0e+01)		(4.6e+00)		(5.3e+00)	
f_{25}	2.0e+02	2.0e+02	·	2.0e+02	·	2.0e+02	·
	(8.8e+00)	(2.2e+00)		(1.3e+01)		(4.1e−01)	
f_{26}	1.6e+02	1.5e+02	·	1.7e+02	·	1.4e+02	−
	(3.2e+01)	(2.9e+01)		(4.6e+01)		(2.3e+01)	
f_{27}	3.0e+02	3.1e+02	·	3.4e+02	+	3.0e+02	+
	(1.7e+01)	(4.3e+01)		(7.5e+01)		(1.3e−02)	
f_{28}	3.0e+02	2.9e+02	·	2.9e+02	·	3.0e+02	+
	(0.0e+00)	(3.9e+01)		(3.9e+01)		(2.1e−13)	
Summary (+/·/−)		0/28/0		3/15/10		10/17/1	

Table 64: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	6.2e+05	4.9e+05	·	3.3e+05	−	5.8e+05	·
	(2.1e+05)	(2.0e+05)		(3.6e+05)		(2.0e+05)	
f_3	5.0e+03	1.1e+03	−	2.8e+05	·	5.8e+04	+
	(3.1e+03)	(6.1e+02)		(1.5e+06)		(5.5e+04)	
f_4	4.8e+03	4.3e+03	·	3.4e+03	−	4.6e+03	·
	(1.6e+03)	(1.3e+03)		(2.7e+03)		(1.1e+03)	
f_5	0.0e+00	0.0e+00	·	5.7e−04	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(4.0e−03)		(0.0e+00)	
f_6	1.2e+00	2.4e+00	·	5.4e+00	·	2.5e−01	−
	(3.2e+00)	(4.2e+00)		(4.9e+00)		(1.4e+00)	
f_7	8.3e−01	2.5e−01	−	2.1e+00	·	3.7e+00	+
	(3.1e−01)	(1.2e−01)		(3.8e+00)		(1.1e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(7.6e−02)	(7.3e−02)		(9.4e−02)		(8.1e−02)	
f_9	8.1e+00	7.7e+00	·	3.2e+00	−	8.3e+00	·
	(6.3e−01)	(8.6e−01)		(1.9e+00)		(5.6e−01)	
f_{10}	6.0e−01	5.7e−01	·	3.9e−01	−	6.0e−01	·
	(8.7e−02)	(8.5e−02)		(1.9e−01)		(8.9e−02)	
f_{11}	1.3e+01	1.6e+00	−	6.3e−01	−	1.7e+01	+
	(2.3e+00)	(1.5e+00)		(6.7e−01)		(2.4e+00)	
f_{12}	3.3e+01	3.1e+01	·	1.9e+01	−	3.2e+01	·
	(4.5e+00)	(4.0e+00)		(6.3e+00)		(3.6e+00)	
f_{13}	3.2e+01	3.0e+01	·	2.5e+01	−	3.1e+01	·
	(3.4e+00)	(4.4e+00)		(8.8e+00)		(4.3e+00)	
f_{14}	7.2e+02	7.0e+01	−	3.8e+01	−	8.1e+02	·
	(1.2e+02)	(2.4e+01)		(4.6e+01)		(1.4e+02)	
f_{15}	1.4e+03	1.4e+03	·	1.0e+03	−	1.4e+03	·
	(1.3e+02)	(1.5e+02)		(2.6e+02)		(1.4e+02)	
f_{16}	1.1e+00	1.2e+00	·	1.0e+00	·	1.1e+00	·
	(2.4e−01)	(2.1e−01)		(3.3e−01)		(2.0e−01)	
f_{17}	2.3e+01	1.5e+01	−	1.0e+01	−	2.7e+01	+
	(2.2e+00)	(1.2e+00)		(3.1e+00)		(2.6e+00)	
f_{18}	4.2e+01	4.1e+01	·	3.8e+01	·	4.1e+01	·
	(3.7e+00)	(3.9e+00)		(7.4e+00)		(3.0e+00)	
f_{19}	2.1e+00	1.7e+00	−	8.8e−01	−	2.0e+00	·
	(3.0e−01)	(2.4e−01)		(2.5e−01)		(3.4e−01)	
f_{20}	3.2e+00	3.1e+00	·	2.9e+00	·	3.1e+00	·
	(1.7e−01)	(1.9e−01)		(3.6e−01)		(2.2e−01)	
f_{21}	3.9e+02	3.8e+02	·	3.7e+02	·	4.0e+02	·
	(3.9e+01)	(6.5e+01)		(7.4e+01)		(0.0e+00)	
f_{22}	9.4e+02	1.9e+02	−	1.1e+02	−	9.7e+02	·
	(1.4e+02)	(7.9e+01)		(8.4e+01)		(1.4e+02)	
f_{23}	1.5e+03	1.5e+03	·	1.1e+03	−	1.5e+03	·
	(1.9e+02)	(1.5e+02)		(2.7e+02)		(2.1e+02)	
f_{24}	2.1e+02	2.0e+02	−	2.0e+02	−	2.2e+02	+
	(9.5e+00)	(1.5e+01)		(1.6e+01)		(4.3e+00)	
f_{25}	2.0e+02	2.0e+02	−	2.0e+02	·	2.1e+02	+
	(9.9e+00)	(9.6e+00)		(1.3e+01)		(3.5e+00)	
f_{26}	1.6e+02	1.6e+02	·	1.7e+02	·	1.7e+02	·
	(2.5e+01)	(2.7e+01)		(3.8e+01)		(2.4e+01)	
f_{27}	3.1e+02	3.1e+02	−	3.4e+02	−	3.1e+02	+
	(1.8e+01)	(4.6e+01)		(8.0e+01)		(5.9e+00)	
f_{28}	3.0e+02	2.9e+02	−	2.7e+02	−	3.0e+02	−
	(2.8e+01)	(4.8e+01)		(7.0e+01)		(2.6e−11)	
Summary (+/·/−)		0/17/11		0/12/16		7/19/2	

Table 65: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	3.7e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.5e+01)		(0.0e+00)		(0.0e+00)	
f_2	3.2e+03	4.6e+06	+	2.3e+03	·	1.3e+03	−
	(2.6e+03)	(1.6e+06)		(2.6e+03)		(1.9e+03)	
f_3	3.7e+01	3.0e+08	+	1.1e+02	·	1.2e+02	·
	(2.3e+02)	(1.1e+08)		(7.5e+02)		(7.5e+02)	
f_4	2.1e−04	1.1e+04	+	2.2e−04	·	1.7e−03	+
	(4.3e−04)	(3.1e+03)		(2.3e−04)		(1.6e−03)	
f_5	1.8e−06	1.6e+01	+	2.8e−08	·	4.3e−09	·
	(1.3e−05)	(5.4e+00)		(2.0e−07)		(3.1e−08)	
f_6	5.3e+00	1.7e+01	+	7.1e+00	·	7.2e+00	·
	(4.8e+00)	(2.9e+00)		(1.0e+01)		(4.4e+00)	
f_7	1.7e+01	3.1e+01	+	1.4e+01	·	8.2e+00	·
	(2.1e+01)	(6.3e+00)		(1.8e+01)		(1.2e+01)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(8.5e−02)	(6.1e−02)		(7.5e−02)		(6.4e−02)	
f_9	2.8e+00	7.8e+00	+	2.9e+00	·	1.8e+00	−
	(1.3e+00)	(6.7e−01)		(1.2e+00)		(1.1e+00)	
f_{10}	1.8e−01	2.8e+01	+	1.9e−01	·	1.4e−01	·
	(9.9e−02)	(8.5e+00)		(1.3e−01)		(1.1e−01)	
f_{11}	8.4e+00	8.1e+00	·	7.4e+00	·	5.9e+00	·
	(4.2e+00)	(1.9e+00)		(4.7e+00)		(2.4e+00)	
f_{12}	1.5e+01	4.7e+01	+	1.5e+01	·	1.5e+01	·
	(6.8e+00)	(5.3e+00)		(7.9e+00)		(8.1e+00)	
f_{13}	2.3e+01	4.6e+01	+	2.5e+01	·	1.8e+01	·
	(9.7e+00)	(6.3e+00)		(8.8e+00)		(7.6e+00)	
f_{14}	2.7e+02	1.0e+02	−	2.4e+02	·	3.3e+02	·
	(1.5e+02)	(3.3e+01)		(1.6e+02)		(2.1e+02)	
f_{15}	8.1e+02	1.4e+03	+	7.9e+02	·	1.2e+03	+
	(3.0e+02)	(1.3e+02)		(2.7e+02)		(2.7e+02)	
f_{16}	8.3e−01	1.1e+00	+	8.7e−01	·	1.2e+00	+
	(2.7e−01)	(1.9e−01)		(2.8e−01)		(1.9e−01)	
f_{17}	1.2e+01	2.5e+01	+	1.2e+01	·	2.1e+01	+
	(3.5e+00)	(4.5e+00)		(3.6e+00)		(3.7e+00)	
f_{18}	2.4e+01	6.5e+01	+	2.5e+01	·	3.4e+01	+
	(7.0e+00)	(7.1e+00)		(8.1e+00)		(5.1e+00)	
f_{19}	8.2e−01	3.7e+00	+	7.7e−01	·	1.2e+00	+
	(3.0e−01)	(8.8e−01)		(2.3e−01)		(2.7e−01)	
f_{20}	2.9e+00	3.6e+00	+	2.8e+00	·	2.8e+00	·
	(6.6e−01)	(1.5e−01)		(6.1e−01)		(5.7e−01)	
f_{21}	3.7e+02	4.0e+02	+	3.7e+02	·	3.7e+02	·
	(7.0e+01)	(4.1e+00)		(6.6e+01)		(6.6e+01)	
f_{22}	3.9e+02	2.2e+02	−	3.9e+02	·	2.6e+02	·
	(1.8e+02)	(8.8e+01)		(1.8e+02)		(1.8e+02)	
f_{23}	8.8e+02	1.5e+03	+	8.7e+02	·	1.2e+03	·
	(3.9e+02)	(1.5e+02)		(3.6e+02)		(3.4e+02)	
f_{24}	2.1e+02	2.2e+02	+	2.1e+02	·	2.1e+02	·
	(5.5e+00)	(3.9e+00)		(4.9e+00)		(6.0e+00)	
f_{25}	2.1e+02	2.2e+02	+	2.1e+02	·	2.1e+02	·
	(1.4e+01)	(2.3e+00)		(1.1e+01)		(1.3e+01)	
f_{26}	2.0e+02	1.8e+02	·	2.0e+02	·	2.0e+02	·
	(6.5e+01)	(2.1e+01)		(6.7e+01)		(6.7e+01)	
f_{27}	4.3e+02	5.0e+02	·	4.1e+02	·	4.1e+02	·
	(9.7e+01)	(3.1e+01)		(1.1e+02)		(1.0e+02)	
f_{28}	3.1e+02	4.7e+02	+	3.3e+02	·	3.1e+02	·
	(9.4e+01)	(4.7e+01)		(1.0e+02)		(9.0e+01)	
Summary (+/·/−)		22/4/2		0/28/0		6/20/2	

Table 66: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	2.8e+02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.3e+02)		(0.0e+00)		(0.0e+00)	
f_2	1.6e+03	5.8e+06	+	2.7e+03	·	2.6e+03	+
	(1.4e+03)	(3.1e+06)		(3.0e+03)		(1.9e+03)	
f_3	2.2e+01	1.8e+09	+	6.6e+01	·	3.1e+02	+
	(1.3e+02)	(1.1e+09)		(4.6e+02)		(1.0e+03)	
f_4	2.2e+01	1.6e+04	+	9.4e+00	−	4.0e+01	+
	(1.4e+01)	(5.9e+03)		(5.1e+00)		(3.1e+01)	
f_5	0.0e+00	1.8e+02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.6e+02)		(0.0e+00)		(0.0e+00)	
f_6	4.3e+00	4.6e+01	+	5.6e+00	·	4.3e+00	·
	(4.9e+00)	(2.1e+01)		(4.9e+00)		(4.8e+00)	
f_7	1.2e−01	5.6e+01	+	7.7e−01	·	3.2e−01	·
	(7.6e−01)	(1.6e+01)		(3.9e+00)		(2.0e+00)	
f_8	2.0e+01	2.1e+01	+	2.0e+01	·	2.0e+01	·
	(7.1e−02)	(7.8e−02)		(7.5e−02)		(6.2e−02)	
f_9	1.1e+00	7.6e+00	+	1.9e+00	·	2.7e+00	·
	(8.7e−01)	(9.6e−01)		(1.3e+00)		(2.7e+00)	
f_{10}	5.4e−01	5.9e+01	+	1.7e−01	−	5.4e−01	·
	(8.8e−02)	(3.1e+01)		(1.1e−01)		(7.6e−02)	
f_{11}	3.5e+00	2.9e+01	+	5.0e+00	·	1.3e+01	+
	(2.2e+00)	(8.5e+00)		(2.1e+00)		(2.4e+00)	
f_{12}	2.7e+01	4.3e+01	+	1.3e+01	−	2.8e+01	·
	(5.2e+00)	(7.4e+00)		(5.5e+00)		(4.3e+00)	
f_{13}	2.7e+01	4.5e+01	+	2.2e+01	−	2.7e+01	·
	(4.5e+00)	(6.8e+00)		(7.8e+00)		(5.0e+00)	
f_{14}	3.9e+02	2.8e+02	·	1.9e+02	−	6.8e+02	+
	(1.9e+02)	(9.5e+01)		(1.4e+02)		(1.4e+02)	
f_{15}	1.4e+03	1.5e+03	+	9.1e+02	−	1.4e+03	·
	(2.1e+02)	(2.2e+02)		(3.2e+02)		(1.4e+02)	
f_{16}	1.1e+00	1.5e+00	+	1.1e+00	·	1.2e+00	·
	(2.0e−01)	(3.1e−01)		(2.5e−01)		(2.0e−01)	
f_{17}	1.5e+01	5.5e+01	+	1.3e+01	−	2.3e+01	+
	(3.1e+00)	(1.2e+01)		(2.3e+00)		(3.1e+00)	
f_{18}	3.7e+01	6.1e+01	+	3.0e+01	−	3.7e+01	·
	(5.2e+00)	(8.7e+00)		(7.7e+00)		(4.6e+00)	
f_{19}	1.6e+00	9.0e+00	+	7.2e−01	−	1.7e+00	·
	(3.2e−01)	(8.3e+00)		(2.5e−01)		(3.5e−01)	
f_{20}	2.7e+00	3.7e+00	+	2.7e+00	·	2.7e+00	·
	(4.4e−01)	(2.2e−01)		(5.3e−01)		(4.0e−01)	
f_{21}	3.6e+02	4.2e+02	+	3.8e+02	·	3.8e+02	·
	(7.7e+01)	(1.5e+01)		(6.2e+01)		(6.1e+01)	
f_{22}	3.2e+02	5.4e+02	+	2.6e+02	·	7.1e+02	+
	(1.6e+02)	(1.7e+02)		(1.3e+02)		(1.8e+02)	
f_{23}	1.3e+03	1.7e+03	+	9.2e+02	−	1.4e+03	·
	(2.3e+02)	(2.3e+02)		(3.4e+02)		(2.0e+02)	
f_{24}	2.0e+02	2.2e+02	+	2.1e+02	·	2.0e+02	·
	(1.1e+01)	(2.9e+00)		(1.4e+01)		(1.2e+01)	
f_{25}	2.0e+02	2.2e+02	+	2.0e+02	·	2.0e+02	·
	(1.3e+01)	(3.5e+00)		(1.4e+01)		(1.1e+01)	
f_{26}	1.9e+02	1.8e+02	·	1.8e+02	−	2.0e+02	+
	(5.4e+01)	(3.1e+01)		(5.5e+01)		(5.8e+01)	
f_{27}	3.7e+02	5.5e+02	+	3.8e+02	·	3.8e+02	·
	(9.3e+01)	(4.6e+01)		(9.7e+01)		(9.5e+01)	
f_{28}	3.0e+02	6.6e+02	+	3.0e+02	·	3.0e+02	·
	(3.2e+01)	(7.6e+01)		(5.3e+01)		(1.4e−13)	
Summary (+/·/−)		26/2/0		0/17/11		8/20/0	

Table 67: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	4.7e−07	2.8e+02	+	0.0e+00	·	0.0e+00	·
	(3.4e−06)	(2.0e+02)		(0.0e+00)		(0.0e+00)	
f_2	8.7e+03	6.4e+06	+	2.4e+03	·	7.3e+03	·
	(2.3e+04)	(3.4e+06)		(3.0e+03)		(3.5e+04)	
f_3	4.7e+03	1.7e+09	+	3.9e+00	−	2.5e+04	·
	(2.3e+04)	(1.1e+09)		(1.4e+01)		(1.4e+05)	
f_4	1.1e+02	1.6e+04	+	1.0e+01	−	4.8e+01	−
	(1.2e+02)	(6.8e+03)		(6.4e+00)		(7.9e+01)	
f_5	4.8e−03	2.2e+02	+	0.0e+00	−	2.4e−06	−
	(1.8e−02)	(1.8e+02)		(0.0e+00)		(1.6e−05)	
f_6	8.2e+00	4.8e+01	+	4.9e+00	−	9.2e+00	·
	(3.3e+00)	(2.2e+01)		(4.9e+00)		(2.2e+00)	
f_7	9.8e−03	5.2e+01	+	5.5e−01	·	4.4e−04	−
	(1.2e−02)	(1.5e+01)		(1.9e+00)		(1.9e−03)	
f_8	2.0e+01	2.0e+01	+	2.0e+01	·	2.0e+01	·
	(7.2e−02)	(1.1e−01)		(7.6e−02)		(7.0e−02)	
f_9	4.2e+00	7.4e+00	+	1.8e+00	−	1.4e+00	−
	(1.5e+00)	(8.7e−01)		(1.1e+00)		(1.9e+00)	
f_{10}	3.1e−01	5.6e+01	+	1.8e−01	−	3.9e−01	+
	(8.8e−02)	(3.1e+01)		(1.3e−01)		(9.2e−02)	
f_{11}	2.1e+00	3.0e+01	+	5.0e+00	+	9.0e+00	+
	(9.3e−01)	(9.0e+00)		(2.3e+00)		(1.4e+00)	
f_{12}	2.1e+01	4.3e+01	+	1.4e+01	−	2.0e+01	·
	(3.6e+00)	(7.3e+00)		(5.9e+00)		(3.8e+00)	
f_{13}	2.0e+01	4.6e+01	+	1.9e+01	·	2.0e+01	·
	(3.1e+00)	(9.1e+00)		(9.1e+00)		(2.5e+00)	
f_{14}	6.3e+02	2.8e+02	−	2.0e+02	−	5.8e+02	·
	(1.4e+02)	(1.1e+02)		(1.4e+02)		(1.1e+02)	
f_{15}	1.3e+03	1.6e+03	+	9.7e+02	−	1.2e+03	·
	(1.6e+02)	(1.8e+02)		(3.0e+02)		(1.4e+02)	
f_{16}	1.1e+00	1.5e+00	+	1.1e+00	·	1.2e+00	·
	(1.7e−01)	(3.3e−01)		(2.4e−01)		(2.2e−01)	
f_{17}	1.3e+01	5.7e+01	+	1.3e+01	·	2.0e+01	+
	(5.8e−01)	(1.3e+01)		(3.2e+00)		(1.6e+00)	
f_{18}	3.0e+01	6.1e+01	+	2.5e+01	·	3.0e+01	·
	(3.5e+00)	(8.4e+00)		(7.5e+00)		(3.5e+00)	
f_{19}	1.4e+00	9.0e+00	+	7.0e−01	−	1.3e+00	·
	(1.8e−01)	(4.2e+00)		(2.7e−01)		(2.0e−01)	
f_{20}	2.7e+00	3.6e+00	+	2.6e+00	·	2.7e+00	·
	(3.0e−01)	(2.8e−01)		(6.1e−01)		(3.3e−01)	
f_{21}	4.0e+02	4.2e+02	+	3.7e+02	·	4.0e+02	·
	(1.1e−08)	(1.9e+01)		(7.4e+01)		(0.0e+00)	
f_{22}	7.5e+02	4.8e+02	−	2.9e+02	−	6.1e+02	−
	(1.7e+02)	(1.6e+02)		(1.5e+02)		(1.5e+02)	
f_{23}	1.3e+03	1.7e+03	+	9.3e+02	−	1.1e+03	−
	(1.7e+02)	(2.4e+02)		(3.2e+02)		(1.6e+02)	
f_{24}	1.7e+02	2.2e+02	+	2.0e+02	+	2.0e+02	·
	(3.1e+01)	(3.0e+00)		(1.5e+01)		(4.9e−04)	
f_{25}	2.0e+02	2.2e+02	+	2.0e+02	+	2.0e+02	−
	(3.2e+00)	(2.6e+00)		(1.4e+01)		(8.3e−05)	
f_{26}	1.2e+02	1.7e+02	+	1.7e+02	·	1.3e+02	·
	(4.3e+00)	(2.3e+01)		(5.5e+01)		(2.4e+01)	
f_{27}	3.0e+02	5.3e+02	+	3.9e+02	·	3.0e+02	−
	(4.5e+00)	(4.1e+01)		(9.8e+01)		(1.7e−04)	
f_{28}	3.0e+02	6.5e+02	+	2.9e+02	·	3.0e+02	·
	(0.0e+00)	(9.0e+01)		(4.8e+01)		(5.6e−14)	
Summary (+/·/−)		26/0/2		3/13/12		3/17/8	

Table 68: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	9.1e+00	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(4.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	1.1e+03	2.5e+06	+	1.8e+03	·	1.3e+02	−
	(1.3e+03)	(9.2e+05)		(3.1e+03)		(2.7e+02)	
f_3	2.9e+00	6.4e+07	+	8.6e−01	·	8.9e+00	·
	(6.3e+00)	(3.6e+07)		(1.9e+00)		(4.2e+01)	
f_4	2.6e−02	8.9e+03	+	1.1e−01	+	1.6e−01	+
	(2.6e−02)	(2.6e+03)		(9.7e−02)		(9.9e−02)	
f_5	1.8e−05	7.0e+00	+	0.0e+00	·	0.0e+00	·
	(7.0e−05)	(2.0e+00)		(0.0e+00)		(0.0e+00)	
f_6	6.1e+00	1.1e+01	+	6.6e+00	·	7.3e+00	·
	(4.8e+00)	(7.1e−01)		(4.6e+00)		(4.3e+00)	
f_7	5.6e−01	1.7e+01	+	2.5e+00	·	5.3e−01	·
	(1.2e+00)	(3.5e+00)		(4.7e+00)		(1.5e+00)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(6.3e−02)	(8.5e−02)		(7.9e−02)		(7.8e−02)	
f_9	1.2e+00	6.2e+00	+	2.4e+00	·	1.5e+00	·
	(8.8e−01)	(9.2e−01)		(1.5e+00)		(1.0e+00)	
f_{10}	9.6e−02	1.1e+01	+	1.5e−01	+	3.8e−01	+
	(8.0e−02)	(4.1e+00)		(7.6e−02)		(1.1e−01)	
f_{11}	4.3e−01	5.6e+00	+	7.1e+00	+	7.3e+00	+
	(7.0e−01)	(1.4e+00)		(4.0e+00)		(3.2e+00)	
f_{12}	1.2e+01	3.7e+01	+	1.1e+01	·	2.2e+01	+
	(5.8e+00)	(4.1e+00)		(5.1e+00)		(5.3e+00)	
f_{13}	1.1e+01	3.5e+01	+	2.2e+01	+	2.0e+01	+
	(4.6e+00)	(5.2e+00)		(8.9e+00)		(5.3e+00)	
f_{14}	2.7e+02	8.0e+01	−	2.2e+02	·	5.1e+02	+
	(1.6e+02)	(2.4e+01)		(1.3e+02)		(1.6e+02)	
f_{15}	1.2e+03	1.3e+03	·	9.1e+02	−	1.3e+03	·
	(1.8e+02)	(1.5e+02)		(2.7e+02)		(2.0e+02)	
f_{16}	1.1e+00	1.1e+00	·	1.1e+00	·	1.1e+00	·
	(1.9e−01)	(2.3e−01)		(2.4e−01)		(1.9e−01)	
f_{17}	1.2e+01	1.8e+01	+	1.4e+01	+	2.0e+01	+
	(5.3e−01)	(2.0e+00)		(3.3e+00)		(3.9e+00)	
f_{18}	3.2e+01	5.5e+01	+	2.5e+01	−	3.2e+01	·
	(4.7e+00)	(6.0e+00)		(6.7e+00)		(3.3e+00)	
f_{19}	1.2e+00	2.6e+00	+	7.2e−01	−	1.5e+00	+
	(2.5e−01)	(5.7e−01)		(2.7e−01)		(1.8e−01)	
f_{20}	2.5e+00	3.2e+00	+	2.5e+00	·	2.7e+00	·
	(5.6e−01)	(1.9e−01)		(6.6e−01)		(5.7e−01)	
f_{21}	4.0e+02	4.0e+02	+	3.7e+02	·	3.9e+02	·
	(2.8e+01)	(2.7e−01)		(7.4e+01)		(4.8e+01)	
f_{22}	2.7e+02	2.1e+02	·	2.9e+02	·	4.7e+02	+
	(1.9e+02)	(9.8e+01)		(1.5e+02)		(2.1e+02)	
f_{23}	1.1e+03	1.4e+03	+	8.9e+02	−	1.2e+03	·
	(2.7e+02)	(1.5e+02)		(2.9e+02)		(2.8e+02)	
f_{24}	2.0e+02	2.1e+02	+	2.0e+02	·	2.0e+02	·
	(2.7e+01)	(7.8e+00)		(1.7e+01)		(1.6e+01)	
f_{25}	2.0e+02	2.1e+02	+	2.1e+02	+	2.0e+02	·
	(1.7e+01)	(4.0e+00)		(1.4e+01)		(1.2e+01)	
f_{26}	1.6e+02	1.7e+02	·	1.7e+02	·	1.7e+02	·
	(4.4e+01)	(2.6e+01)		(6.3e+01)		(5.3e+01)	
f_{27}	3.2e+02	4.0e+02	+	3.9e+02	+	3.3e+02	·
	(6.1e+01)	(1.9e+01)		(9.8e+01)		(7.4e+01)	
f_{28}	3.0e+02	3.7e+02	+	3.0e+02	·	3.0e+02	·
	(6.9e+01)	(5.4e+01)		(8.2e+01)		(7.8e+01)	
Summary (+/·/−)		22/5/1		7/17/4		9/18/1	

Table 69: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	3.8e+04	3.0e+04	·	1.7e+04	−	2.7e+04	·
	(2.1e+04)	(1.5e+04)		(1.3e+04)		(9.0e+03)	
f_3	7.2e+00	3.3e+00	·	2.2e+02	−	2.1e+01	+
	(8.3e+00)	(4.0e+00)		(7.5e+02)		(1.8e+01)	
f_4	5.8e+02	5.5e+02	·	3.1e+02	−	4.0e+02	−
	(1.8e+02)	(2.4e+02)		(2.7e+02)		(1.3e+02)	
f_5	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_6	8.4e+00	9.1e+00	·	4.1e+00	−	7.4e+00	·
	(3.3e+00)	(2.4e+00)		(4.8e+00)		(4.0e+00)	
f_7	2.1e−03	9.0e−04	−	3.4e−01	·	4.2e−02	+
	(1.2e−03)	(7.1e−04)		(1.6e+00)		(1.9e−02)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(7.4e−02)	(7.9e−02)		(9.0e−02)		(7.5e−02)	
f_9	4.9e+00	3.7e+00	·	1.8e+00	−	7.7e+00	+
	(3.0e+00)	(2.9e+00)		(1.2e+00)		(8.4e−01)	
f_{10}	5.0e−01	4.6e−01	·	1.9e−01	−	5.3e−01	·
	(7.1e−02)	(8.3e−02)		(9.8e−02)		(6.6e−02)	
f_{11}	9.0e+00	4.8e−04	−	4.6e+00	−	1.2e+01	+
	(2.3e+00)	(3.4e−03)		(2.4e+00)		(2.1e+00)	
f_{12}	2.7e+01	2.5e+01	·	1.6e+01	−	2.5e+01	·
	(3.4e+00)	(4.7e+00)		(6.9e+00)		(4.0e+00)	
f_{13}	2.6e+01	2.6e+01	·	2.2e+01	·	2.5e+01	·
	(4.2e+00)	(3.9e+00)		(9.3e+00)		(3.2e+00)	
f_{14}	4.9e+02	6.0e+01	−	1.5e+02	−	7.4e+02	+
	(1.1e+02)	(2.0e+01)		(1.1e+02)		(1.2e+02)	
f_{15}	1.4e+03	1.4e+03	·	1.0e+03	−	1.4e+03	·
	(1.7e+02)	(1.5e+02)		(2.5e+02)		(1.4e+02)	
f_{16}	1.1e+00	1.2e+00	·	1.1e+00	·	1.1e+00	·
	(2.2e−01)	(1.7e−01)		(2.3e−01)		(1.5e−01)	
f_{17}	2.1e+01	1.3e+01	−	1.4e+01	−	2.3e+01	+
	(1.6e+00)	(6.8e−01)		(3.5e+00)		(2.1e+00)	
f_{18}	3.6e+01	3.5e+01	·	3.2e+01	−	3.5e+01	·
	(3.4e+00)	(3.7e+00)		(8.2e+00)		(4.4e+00)	
f_{19}	1.7e+00	1.5e+00	−	8.0e−01	−	1.6e+00	·
	(2.7e−01)	(2.0e−01)		(2.5e−01)		(2.4e−01)	
f_{20}	2.8e+00	2.8e+00	·	2.6e+00	·	2.8e+00	·
	(2.0e−01)	(2.9e−01)		(3.9e−01)		(2.1e−01)	
f_{21}	4.0e+02	4.0e+02	·	3.7e+02	·	4.0e+02	·
	(2.8e+01)	(2.8e+01)		(6.6e+01)		(0.0e+00)	
f_{22}	6.6e+02	1.6e+02	−	2.4e+02	−	8.8e+02	+
	(1.6e+02)	(7.8e+01)		(1.5e+02)		(1.5e+02)	
f_{23}	1.3e+03	1.3e+03	·	9.8e+02	−	1.4e+03	·
	(1.6e+02)	(1.1e+02)		(2.4e+02)		(1.6e+02)	
f_{24}	2.0e+02	2.0e+02	·	2.0e+02	·	2.0e+02	·
	(3.4e+00)	(1.8e+01)		(1.0e+01)		(3.9e+00)	
f_{25}	2.0e+02	2.0e+02	−	2.0e+02	·	2.0e+02	+
	(1.8e+00)	(8.3e+00)		(4.6e+00)		(4.8e−02)	
f_{26}	1.5e+02	1.5e+02	·	1.8e+02	·	1.4e+02	·
	(3.2e+01)	(2.5e+01)		(5.5e+01)		(2.5e+01)	
f_{27}	3.1e+02	3.0e+02	·	3.6e+02	+	3.0e+02	+
	(3.6e+01)	(4.1e−02)		(8.8e+01)		(7.3e−03)	
f_{28}	3.0e+02	3.0e+02	·	2.9e+02	·	3.0e+02	+
	(0.0e+00)	(2.8e+01)		(3.9e+01)		(1.7e−13)	
Summary (+/·/−)		0/21/7		1/12/15		10/17/1	

Table 70: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	6.1e−01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(3.7e−01)		(0.0e+00)		(0.0e+00)	
f_2	4.6e+02	7.3e+05	+	1.7e+03	+	4.0e+02	·
	(7.5e+02)	(3.3e+05)		(2.0e+03)		(4.4e+02)	
f_3	2.0e+00	3.0e+06	+	2.4e+00	·	6.1e+02	·
	(3.4e+00)	(6.4e+06)		(8.8e+00)		(2.8e+03)	
f_4	4.6e−02	7.1e+03	+	2.4e+00	+	6.5e+00	+
	(2.7e−02)	(2.9e+03)		(2.5e+00)		(4.2e+00)	
f_5	1.7e−02	8.2e−01	+	0.0e+00	−	0.0e+00	−
	(7.7e−02)	(3.9e−01)		(0.0e+00)		(0.0e+00)	
f_6	7.4e+00	9.5e+00	+	7.1e+00	·	5.0e+00	·
	(4.5e+00)	(1.9e+00)		(4.3e+00)		(5.0e+00)	
f_7	2.4e−01	3.2e+00	+	1.6e+00	+	9.0e−03	+
	(1.0e+00)	(1.2e+00)		(5.0e+00)		(2.4e−02)	
f_8	2.0e+01	2.0e+01	·	2.0e+01	·	2.0e+01	·
	(7.0e−02)	(6.7e−02)		(6.0e−02)		(6.9e−02)	
f_9	7.0e−01	3.1e+00	+	1.7e+00	+	1.2e+00	·
	(8.0e−01)	(8.7e−01)		(1.2e+00)		(1.4e+00)	
f_{10}	9.9e−02	2.1e+00	+	1.8e−01	+	5.1e−01	+
	(1.1e−01)	(6.8e−01)		(1.3e−01)		(9.1e−02)	
f_{11}	1.2e−01	2.0e+00	+	5.9e+00	+	1.2e+01	+
	(3.2e−01)	(7.6e−01)		(2.7e+00)		(2.7e+00)	
f_{12}	1.6e+01	2.5e+01	+	1.2e+01	·	2.5e+01	+
	(4.3e+00)	(4.0e+00)		(6.0e+00)		(4.1e+00)	
f_{13}	1.4e+01	2.3e+01	+	2.1e+01	+	2.5e+01	+
	(4.4e+00)	(4.8e+00)		(7.9e+00)		(4.7e+00)	
f_{14}	3.9e+02	5.5e+01	−	2.3e+02	−	6.5e+02	+
	(1.4e+02)	(1.7e+01)		(1.4e+02)		(1.3e+02)	
f_{15}	1.2e+03	1.2e+03	·	9.0e+02	−	1.3e+03	+
	(1.6e+02)	(1.5e+02)		(3.5e+02)		(1.4e+02)	
f_{16}	1.1e+00	1.2e+00	·	1.0e+00	·	1.1e+00	·
	(2.3e−01)	(2.1e−01)		(2.7e−01)		(1.7e−01)	
f_{17}	1.1e+01	1.4e+01	+	1.3e+01	+	2.3e+01	+
	(4.1e−01)	(1.0e+00)		(4.0e+00)		(2.1e+00)	
f_{18}	2.9e+01	3.9e+01	+	2.8e+01	·	3.5e+01	+
	(2.7e+00)	(3.9e+00)		(7.2e+00)		(5.1e+00)	
f_{19}	1.3e+00	1.7e+00	+	6.6e−01	−	1.6e+00	+
	(2.4e−01)	(2.8e−01)		(2.0e−01)		(2.8e−01)	
f_{20}	2.4e+00	2.8e+00	+	2.7e+00	·	2.8e+00	+
	(4.6e−01)	(4.0e−01)		(6.7e−01)		(5.0e−01)	
f_{21}	3.9e+02	3.9e+02	+	3.7e+02	·	3.8e+02	·
	(4.6e+01)	(4.7e+01)		(7.6e+01)		(7.4e+01)	
f_{22}	3.8e+02	1.4e+02	−	2.5e+02	−	6.1e+02	+
	(1.7e+02)	(5.9e+01)		(1.3e+02)		(1.6e+02)	
f_{23}	1.1e+03	1.1e+03	·	8.8e+02	·	1.4e+03	+
	(2.6e+02)	(1.2e+02)		(2.9e+02)		(2.1e+02)	
f_{24}	2.0e+02	2.0e+02	+	2.1e+02	+	2.0e+02	+
	(1.3e+01)	(2.0e+01)		(4.8e+00)		(4.6e+00)	
f_{25}	2.0e+02	2.0e+02	+	2.1e+02	+	2.0e+02	+
	(2.4e+00)	(1.3e+01)		(5.7e+00)		(3.9e+00)	
f_{26}	1.4e+02	1.5e+02	+	1.9e+02	·	1.8e+02	+
	(3.9e+01)	(2.9e+01)		(7.1e+01)		(5.5e+01)	
f_{27}	3.1e+02	3.4e+02	+	3.8e+02	+	3.6e+02	+
	(3.9e+01)	(1.2e+01)		(9.7e+01)		(9.1e+01)	
f_{28}	3.2e+02	3.1e+02	+	3.2e+02	·	3.1e+02	·
	(6.3e+01)	(4.5e+01)		(7.0e+01)		(3.9e+01)	
Summary (+/·/−)		22/4/2		11/12/5		18/9/1	

Table 71: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	0.0e+00	0.0e+00	·	1.1e−08	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(6.5e−08)		(0.0e+00)	
f_3	5.4e−01	1.8e−01	·	2.7e+01	−	1.4e−01	·
	(1.5e+00)	(2.0e−01)		(1.4e+02)		(9.1e−02)	
f_4	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_5	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_6	1.2e+00	6.0e−01	·	2.9e+00	·	5.9e−01	·
	(3.2e+00)	(2.3e+00)		(4.4e+00)		(2.3e+00)	
f_7	1.2e−04	1.3e−04	·	1.0e+01	+	8.4e−03	+
	(2.0e−04)	(1.3e−04)		(1.7e+01)		(6.1e−03)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(7.1e−02)	(7.7e−02)		(1.1e−01)		(7.1e−02)	
f_9	7.9e−01	5.9e−01	·	3.4e+00	+	7.1e+00	+
	(7.9e−01)	(6.5e−01)		(2.2e+00)		(1.6e+00)	
f_{10}	5.0e−02	5.6e−02	·	3.1e−01	+	4.8e−01	+
	(4.2e−02)	(4.9e−02)		(2.5e−01)		(7.1e−02)	
f_{11}	2.3e−01	4.2e−01	·	1.1e+01	+	2.1e+01	+
	(4.6e−01)	(6.7e−01)		(5.3e+00)		(3.3e+00)	
f_{12}	9.3e+00	8.4e+00	·	2.4e+01	+	2.6e+01	+
	(5.2e+00)	(3.9e+00)		(1.2e+01)		(4.4e+00)	
f_{13}	1.1e+01	1.1e+01	·	3.5e+01	+	2.6e+01	+
	(5.7e+00)	(6.0e+00)		(1.2e+01)		(4.3e+00)	
f_{14}	3.2e+01	1.8e+01	·	4.5e+02	+	1.1e+03	+
	(2.8e+01)	(1.5e+01)		(1.6e+02)		(1.5e+02)	
f_{15}	9.9e+02	1.0e+03	·	1.4e+03	+	1.4e+03	+
	(2.8e+02)	(2.9e+02)		(3.3e+02)		(1.2e+02)	
f_{16}	1.1e+00	1.0e+00	·	1.7e+00	+	1.2e+00	·
	(2.6e−01)	(3.4e−01)		(4.2e−01)		(2.2e−01)	
f_{17}	1.2e+01	1.2e+01	·	2.3e+01	+	3.1e+01	+
	(5.5e−01)	(6.8e−01)		(6.3e+00)		(3.1e+00)	
f_{18}	2.9e+01	2.8e+01	·	5.2e+01	+	3.7e+01	+
	(5.7e+00)	(6.1e+00)		(1.0e+01)		(3.8e+00)	
f_{19}	6.7e−01	5.7e−01	·	1.4e+00	+	2.1e+00	+
	(2.0e−01)	(1.7e−01)		(5.0e−01)		(3.4e−01)	
f_{20}	2.1e+00	2.2e+00	·	3.4e+00	+	2.6e+00	+
	(4.2e−01)	(4.1e−01)		(4.7e−01)		(2.1e−01)	
f_{21}	3.8e+02	3.7e+02	·	3.7e+02	·	4.0e+02	·
	(6.0e+01)	(8.1e+01)		(7.2e+01)		(0.0e+00)	
f_{22}	7.8e+01	7.6e+01	·	4.8e+02	+	1.3e+03	+
	(4.5e+01)	(5.9e+01)		(2.2e+02)		(1.7e+02)	
f_{23}	8.1e+02	7.5e+02	·	1.4e+03	+	1.4e+03	+
	(3.3e+02)	(3.5e+02)		(3.4e+02)		(1.7e+02)	
f_{24}	2.0e+02	2.0e+02	·	2.1e+02	+	2.0e+02	·
	(1.9e+01)	(2.0e+01)		(5.0e+00)		(1.8e+00)	
f_{25}	2.0e+02	2.0e+02	·	2.1e+02	+	2.0e+02	·
	(1.3e+01)	(2.0e+01)		(9.7e+00)		(6.3e−01)	
f_{26}	1.4e+02	1.4e+02	·	1.9e+02	+	1.4e+02	·
	(4.5e+01)	(4.3e+01)		(6.0e+01)		(2.9e+01)	
f_{27}	3.1e+02	3.0e+02	·	3.8e+02	+	3.0e+02	+
	(3.4e+01)	(2.0e+01)		(9.9e+01)		(1.0e−03)	
f_{28}	2.7e+02	2.6e+02	·	2.8e+02	·	3.0e+02	+
	(7.3e+01)	(7.7e+01)		(8.8e+01)		(2.5e−13)	
Summary (+/·/−)		0/28/0		20/7/1		16/12/0	

Table 72: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	6.2e+00	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(1.1e+01)		(0.0e+00)	
f_2	8.6e−01	1.2e−01	−	1.0e+06	+	2.8e−01	−
	(5.4e−01)	(6.5e−02)		(1.2e+06)		(1.2e−01)	
f_3	5.4e+02	3.1e+00	−	8.0e+07	+	8.3e+03	+
	(1.9e+03)	(5.5e+00)		(1.5e+08)		(1.1e+04)	
f_4	6.4e−03	8.1e−04	−	1.6e+04	+	2.1e−03	−
	(2.9e−03)	(5.1e−04)		(6.9e+03)		(9.5e−04)	
f_5	0.0e+00	0.0e+00	·	2.6e+00	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(3.5e+00)		(0.0e+00)	
f_6	3.5e−07	1.2e−07	−	5.7e+00	+	9.2e−08	−
	(1.9e−07)	(1.7e−07)		(5.3e+00)		(4.6e−08)	
f_7	4.9e−01	5.3e−02	−	2.4e+01	+	2.3e+00	+
	(1.9e−01)	(2.4e−02)		(2.1e+01)		(7.8e−01)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(5.8e−02)	(9.5e−02)		(1.2e−01)		(8.2e−02)	
f_9	8.1e+00	9.6e−01	−	6.5e+00	−	8.5e+00	+
	(5.5e−01)	(8.6e−01)		(1.8e+00)		(5.7e−01)	
f_{10}	5.5e−01	1.6e−01	−	7.0e+00	+	5.4e−01	·
	(6.5e−02)	(1.0e−01)		(1.1e+01)		(8.2e−02)	
f_{11}	2.5e+01	1.7e+00	−	1.1e+01	−	2.6e+01	·
	(3.1e+00)	(1.1e+00)		(3.8e+00)		(5.0e+00)	
f_{12}	3.2e+01	1.1e+01	−	3.9e+01	·	3.2e+01	·
	(4.5e+00)	(5.1e+00)		(9.9e+00)		(3.7e+00)	
f_{13}	3.2e+01	1.5e+01	−	4.3e+01	+	3.2e+01	·
	(3.9e+00)	(7.8e+00)		(1.3e+01)		(4.6e+00)	
f_{14}	1.2e+03	3.8e+01	−	3.0e+02	−	1.2e+03	·
	(1.6e+02)	(3.3e+01)		(1.6e+02)		(1.4e+02)	
f_{15}	1.4e+03	1.1e+03	−	1.5e+03	·	1.4e+03	·
	(1.4e+02)	(3.1e+02)		(3.2e+02)		(1.2e+02)	
f_{16}	1.1e+00	1.3e+00	+	1.7e+00	+	1.1e+00	·
	(2.2e−01)	(3.0e−01)		(4.4e−01)		(2.1e−01)	
f_{17}	3.6e+01	1.3e+01	−	3.1e+01	·	3.8e+01	·
	(5.0e+00)	(9.8e−01)		(1.1e+01)		(3.9e+00)	
f_{18}	4.3e+01	3.5e+01	−	6.5e+01	+	4.3e+01	·
	(4.0e+00)	(6.6e+00)		(1.2e+01)		(4.9e+00)	
f_{19}	2.5e+00	6.4e−01	−	2.2e+00	·	2.6e+00	·
	(3.2e−01)	(2.0e−01)		(7.7e−01)		(4.1e−01)	
f_{20}	3.0e+00	2.6e+00	−	3.7e+00	+	3.0e+00	·
	(2.4e−01)	(4.3e−01)		(3.1e−01)		(2.0e−01)	
f_{21}	3.4e+02	3.5e+02	·	3.6e+02	+	4.0e+02	·
	(9.2e+01)	(8.8e+01)		(8.1e+01)		(0.0e+00)	
f_{22}	1.3e+03	9.6e+01	−	4.5e+02	−	1.3e+03	·
	(1.7e+02)	(6.6e+01)		(1.9e+02)		(1.6e+02)	
f_{23}	1.5e+03	9.9e+02	−	1.7e+03	+	1.5e+03	·
	(1.7e+02)	(3.5e+02)		(3.3e+02)		(1.8e+02)	
f_{24}	2.0e+02	2.0e+02	−	2.1e+02	+	2.1e+02	+
	(1.4e+01)	(1.8e+01)		(4.8e+00)		(4.5e+00)	
f_{25}	2.0e+02	2.0e+02	−	2.1e+02	+	2.1e+02	+
	(1.4e+00)	(2.2e+00)		(4.6e+00)		(4.1e+00)	
f_{26}	1.6e+02	1.5e+02	·	1.8e+02	+	1.7e+02	·
	(3.3e+01)	(4.4e+01)		(2.9e+01)		(2.8e+01)	
f_{27}	3.0e+02	3.0e+02	−	4.7e+02	+	3.0e+02	+
	(6.7e−01)	(2.5e+01)		(8.5e+01)		(1.0e+00)	
f_{28}	2.8e+02	2.5e+02	−	3.5e+02	+	3.0e+02	−
	(6.5e+01)	(8.8e+01)		(1.1e+02)		(3.3e−09)	
Summary (+/·/−)		1/5/22		20/4/4		6/18/4	

Table 73: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	4.0e−03	3.2e+00	+	1.5e−01	·	3.2e−07	·
	(2.8e−02)	(3.3e+00)		(9.8e−01)		(1.6e−06)	
f_2	3.8e+03	4.0e+05	+	7.9e+03	·	2.0e+03	·
	(5.5e+03)	(6.1e+05)		(1.5e+04)		(3.7e+03)	
f_3	1.0e+07	1.6e+07	+	1.6e+06	·	5.5e+04	−
	(5.0e+07)	(1.9e+07)		(4.6e+06)		(3.1e+05)	
f_4	1.2e+00	6.0e+03	+	2.9e−01	·	4.4e−02	−
	(3.9e+00)	(5.5e+03)		(6.8e−01)		(2.8e−01)	
f_5	1.3e+01	2.4e+00	·	1.6e+01	·	1.9e+01	·
	(1.6e+01)	(1.6e+00)		(2.3e+01)		(2.6e+01)	
f_6	2.2e+01	9.0e+00	·	1.5e+01	·	1.0e+01	·
	(2.8e+01)	(3.0e+00)		(1.9e+01)		(1.1e+01)	
f_7	4.0e+01	1.0e+01	−	3.5e+01	·	2.4e+01	·
	(2.4e+01)	(6.7e+00)		(2.5e+01)		(3.0e+01)	
f_8	2.1e+01	2.0e+01	−	2.1e+01	·	2.0e+01	−
	(1.1e−01)	(8.1e−02)		(1.2e−01)		(7.0e−02)	
f_9	4.0e+00	4.5e+00	·	3.7e+00	·	3.4e+00	·
	(1.2e+00)	(1.5e+00)		(1.2e+00)		(1.4e+00)	
f_{10}	5.0e+00	2.5e+00	·	5.2e+00	·	1.4e+00	·
	(7.3e+00)	(2.2e+00)		(7.4e+00)		(2.4e+00)	
f_{11}	1.8e+01	5.3e+00	−	1.8e+01	·	1.6e+01	·
	(7.9e+00)	(2.2e+00)		(8.5e+00)		(1.0e+01)	
f_{12}	2.6e+01	3.0e+01	·	2.5e+01	·	2.1e+01	·
	(1.3e+01)	(1.1e+01)		(1.2e+01)		(9.4e+00)	
f_{13}	3.7e+01	3.3e+01	·	3.8e+01	·	3.1e+01	·
	(1.3e+01)	(1.2e+01)		(1.4e+01)		(1.3e+01)	
f_{14}	5.0e+02	8.9e+01	−	5.3e+02	·	4.2e+02	·
	(2.1e+02)	(4.9e+01)		(2.3e+02)		(2.9e+02)	
f_{15}	9.9e+02	1.4e+03	+	1.0e+03	·	6.9e+02	·
	(3.8e+02)	(2.1e+02)		(3.6e+02)		(4.3e+02)	
f_{16}	1.2e+00	1.3e+00	·	1.3e+00	·	1.2e+00	·
	(4.5e−01)	(2.5e−01)		(4.9e−01)		(2.3e−01)	
f_{17}	2.3e+01	1.8e+01	−	2.5e+01	·	2.9e+01	·
	(8.3e+00)	(2.7e+00)		(7.9e+00)		(8.0e+00)	
f_{18}	3.8e+01	4.7e+01	+	4.0e+01	·	3.8e+01	·
	(9.5e+00)	(9.7e+00)		(1.2e+01)		(7.8e+00)	
f_{19}	1.2e+00	1.2e+00	·	1.3e+00	·	9.5e−01	·
	(4.6e−01)	(4.4e−01)		(6.8e−01)		(4.6e−01)	
f_{20}	3.4e+00	3.5e+00	·	3.4e+00	·	3.0e+00	−
	(4.7e−01)	(3.1e−01)		(4.6e−01)		(6.1e−01)	
f_{21}	3.9e+02	3.8e+02	+	3.7e+02	·	3.6e+02	·
	(4.9e+01)	(6.1e+01)		(7.0e+01)		(7.5e+01)	
f_{22}	6.4e+02	1.6e+02	−	6.8e+02	·	4.3e+02	−
	(2.6e+02)	(6.9e+01)		(2.9e+02)		(2.1e+02)	
f_{23}	1.1e+03	1.5e+03	+	1.2e+03	·	7.3e+02	−
	(4.6e+02)	(2.0e+02)		(3.5e+02)		(4.2e+02)	
f_{24}	2.1e+02	2.1e+02	·	2.2e+02	·	2.1e+02	·
	(4.2e+00)	(2.0e+01)		(4.3e+00)		(5.9e+00)	
f_{25}	2.1e+02	2.1e+02	−	2.1e+02	·	2.1e+02	·
	(1.3e+01)	(1.2e+01)		(1.5e+01)		(1.4e+01)	
f_{26}	2.1e+02	1.5e+02	·	2.2e+02	·	2.1e+02	·
	(8.2e+01)	(3.2e+01)		(8.4e+01)		(8.2e+01)	
f_{27}	4.8e+02	3.7e+02	−	4.8e+02	·	4.5e+02	·
	(8.4e+01)	(3.3e+01)		(8.0e+01)		(9.9e+01)	
f_{28}	3.6e+02	2.9e+02	·	3.5e+02	·	3.5e+02	·
	(1.7e+02)	(9.7e+01)		(1.6e+02)		(1.4e+02)	
Summary (+/·/−)		8/12/8		0/28/0		0/22/6	

Table 74: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	1.1e+03	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(5.9e+02)		(0.0e+00)		(0.0e+00)	
f_2	0.0e+00	1.7e+07	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(8.1e+06)		(0.0e+00)		(0.0e+00)	
f_3	4.0e−04	8.4e+09	+	4.3e−01	·	2.8e−02	·
	(2.8e−03)	(5.1e+09)		(1.5e+00)		(1.8e−01)	
f_4	0.0e+00	3.6e+04	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.2e+04)		(0.0e+00)		(0.0e+00)	
f_5	0.0e+00	7.1e+02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(5.3e+02)		(0.0e+00)		(0.0e+00)	
f_6	3.5e+00	1.1e+02	+	5.2e+00	·	4.9e+00	·
	(4.7e+00)	(5.0e+01)		(4.6e+00)		(1.0e+01)	
f_7	9.4e−02	1.1e+02	+	9.2e+00	+	6.3e−02	·
	(3.3e−01)	(3.4e+01)		(1.8e+01)		(4.2e−01)	
f_8	2.0e+01	2.1e+01	+	2.1e+01	+	2.0e+01	·
	(7.9e−02)	(1.2e−01)		(9.2e−02)		(8.6e−02)	
f_9	1.9e+00	9.6e+00	+	2.9e+00	·	1.5e+00	·
	(1.1e+00)	(1.0e+00)		(1.7e+00)		(9.4e−01)	
f_{10}	3.2e−01	1.9e+02	+	2.7e−01	·	5.3e−01	·
	(2.2e−01)	(1.1e+02)		(2.2e−01)		(9.7e−02)	
f_{11}	7.4e+00	5.7e+01	+	1.1e+01	·	2.3e+01	+
	(4.7e+00)	(1.7e+01)		(5.2e+00)		(4.4e+00)	
f_{12}	2.2e+01	7.7e+01	+	2.3e+01	·	2.7e+01	·
	(7.3e+00)	(1.7e+01)		(1.0e+01)		(4.7e+00)	
f_{13}	2.1e+01	7.5e+01	+	3.0e+01	+	2.7e+01	+
	(8.7e+00)	(1.3e+01)		(1.3e+01)		(4.9e+00)	
f_{14}	4.3e+02	5.4e+02	·	4.7e+02	·	1.1e+03	+
	(3.0e+02)	(1.9e+02)		(2.5e+02)		(1.6e+02)	
f_{15}	1.3e+03	2.0e+03	+	1.3e+03	·	1.4e+03	·
	(2.7e+02)	(2.3e+02)		(3.6e+02)		(1.8e+02)	
f_{16}	1.1e+00	2.4e+00	+	1.5e+00	+	1.1e+00	·
	(2.1e−01)	(5.1e−01)		(4.8e−01)		(2.3e−01)	
f_{17}	2.1e+01	9.7e+01	+	2.2e+01	·	3.2e+01	+
	(4.7e+00)	(2.5e+01)		(5.8e+00)		(4.6e+00)	
f_{18}	3.5e+01	1.0e+02	+	4.6e+01	+	3.5e+01	·
	(5.4e+00)	(2.0e+01)		(9.7e+00)		(5.3e+00)	
f_{19}	1.6e+00	1.9e+02	+	1.2e+00	·	2.0e+00	+
	(6.0e−01)	(5.3e+02)		(5.0e−01)		(3.3e−01)	
f_{20}	2.7e+00	4.2e+00	+	3.3e+00	+	2.8e+00	·
	(5.6e−01)	(2.8e−01)		(4.8e−01)		(5.6e−01)	
f_{21}	3.7e+02	4.9e+02	+	3.9e+02	·	3.9e+02	·
	(7.4e+01)	(4.3e+01)		(4.1e+01)		(3.9e+01)	
f_{22}	3.5e+02	1.0e+03	+	5.5e+02	+	1.1e+03	+
	(2.0e+02)	(2.8e+02)		(2.4e+02)		(2.2e+02)	
f_{23}	1.3e+03	2.2e+03	+	1.4e+03	·	1.4e+03	·
	(3.7e+02)	(2.2e+02)		(3.9e+02)		(2.0e+02)	
f_{24}	2.0e+02	2.3e+02	+	2.0e+02	·	2.0e+02	·
	(2.2e+01)	(1.2e+01)		(2.3e+01)		(1.9e+01)	
f_{25}	2.0e+02	2.3e+02	+	2.1e+02	+	2.0e+02	·
	(1.3e+01)	(3.7e+00)		(1.3e+01)		(1.2e+01)	
f_{26}	1.9e+02	2.0e+02	+	2.0e+02	·	2.0e+02	·
	(6.2e+01)	(1.5e+01)		(6.5e+01)		(6.0e+01)	
f_{27}	3.6e+02	6.4e+02	+	4.1e+02	+	3.8e+02	·
	(9.3e+01)	(4.0e+01)		(1.1e+02)		(9.6e+01)	
f_{28}	2.8e+02	8.2e+02	+	2.9e+02	·	2.8e+02	·
	(6.0e+01)	(1.2e+02)		(7.4e+01)		(6.5e+01)	
Summary (+/·/−)		27/1/0		9/19/0		6/22/0	

Table 75: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.2e−01	1.0e+03	+	0.0e+00	−	0.0e+00	−
	(4.0e−01)	(6.6e+02)		(0.0e+00)		(0.0e+00)	
f_2	1.9e+04	1.8e+07	+	0.0e+00	−	2.2e+04	·
	(4.0e+04)	(1.0e+07)		(0.0e+00)		(4.1e+04)	
f_3	4.3e+05	6.9e+09	+	1.3e−01	−	2.4e+06	·
	(9.4e+05)	(3.6e+09)		(8.8e−01)		(9.7e+06)	
f_4	2.0e+02	3.5e+04	+	0.0e+00	−	4.2e+02	·
	(3.1e+02)	(1.2e+04)		(0.0e+00)		(5.9e+02)	
f_5	3.7e+00	8.7e+02	+	0.0e+00	−	3.3e+00	−
	(1.0e+01)	(6.5e+02)		(0.0e+00)		(1.4e+01)	
f_6	7.1e+00	1.2e+02	+	5.2e+00	·	6.2e+00	·
	(7.1e+00)	(5.6e+01)		(4.8e+00)		(4.3e+00)	
f_7	7.3e−03	1.2e+02	+	8.1e+00	+	4.4e−03	−
	(3.7e−02)	(4.5e+01)		(1.3e+01)		(2.5e−02)	
f_8	2.0e+01	2.1e+01	+	2.1e+01	+	2.0e+01	·
	(7.1e−02)	(1.0e−01)		(7.9e−02)		(8.3e−02)	
f_9	8.7e−01	9.6e+00	+	2.9e+00	+	7.3e−01	·
	(7.1e−01)	(9.7e−01)		(1.5e+00)		(6.3e−01)	
f_{10}	4.8e−02	2.0e+02	+	2.8e−01	+	1.5e−01	·
	(6.5e−02)	(1.1e+02)		(2.0e−01)		(1.7e−01)	
f_{11}	9.3e+00	5.9e+01	+	1.2e+01	·	1.5e+01	+
	(2.3e+00)	(1.5e+01)		(5.4e+00)		(2.9e+00)	
f_{12}	1.6e+01	7.5e+01	+	2.2e+01	·	2.0e+01	+
	(3.5e+00)	(1.5e+01)		(1.1e+01)		(3.6e+00)	
f_{13}	2.0e+01	7.8e+01	+	3.0e+01	+	1.9e+01	·
	(3.4e+00)	(1.6e+01)		(1.2e+01)		(3.5e+00)	
f_{14}	1.0e+03	5.6e+02	−	4.4e+02	−	9.4e+02	·
	(1.7e+02)	(2.2e+02)		(2.3e+02)		(1.5e+02)	
f_{15}	1.2e+03	2.0e+03	+	1.3e+03	·	1.2e+03	·
	(1.5e+02)	(2.2e+02)		(3.5e+02)		(1.5e+02)	
f_{16}	9.7e−01	2.4e+00	+	1.6e+00	+	1.2e+00	+
	(1.7e−01)	(5.1e−01)		(4.4e−01)		(2.1e−01)	
f_{17}	1.9e+01	9.8e+01	+	2.1e+01	·	2.6e+01	+
	(1.7e+00)	(2.8e+01)		(7.3e+00)		(2.6e+00)	
f_{18}	2.7e+01	1.1e+02	+	4.4e+01	+	2.9e+01	·
	(3.6e+00)	(2.1e+01)		(9.2e+00)		(2.8e+00)	
f_{19}	1.6e+00	3.1e+02	+	1.3e+00	−	1.6e+00	·
	(2.7e−01)	(6.6e+02)		(5.1e−01)		(2.8e−01)	
f_{20}	2.4e+00	4.3e+00	+	3.4e+00	+	2.3e+00	·
	(3.5e−01)	(1.9e−01)		(4.5e−01)		(3.2e−01)	
f_{21}	4.0e+02	5.0e+02	+	3.6e+02	−	4.0e+02	−
	(4.4e−03)	(4.6e+01)		(8.8e+01)		(6.9e−04)	
f_{22}	1.0e+03	1.0e+03	·	5.2e+02	−	7.4e+02	−
	(1.7e+02)	(3.2e+02)		(2.1e+02)		(2.4e+02)	
f_{23}	1.1e+03	2.2e+03	+	1.4e+03	+	9.4e+02	−
	(1.9e+02)	(2.6e+02)		(4.0e+02)		(1.5e+02)	
f_{24}	1.7e+02	2.3e+02	+	2.0e+02	+	2.0e+02	·
	(3.8e+01)	(1.2e+01)		(2.0e+01)		(1.9e−01)	
f_{25}	2.0e+02	2.3e+02	+	2.0e+02	+	2.0e+02	·
	(2.4e−02)	(4.9e+00)		(2.0e+01)		(5.8e−03)	
f_{26}	1.2e+02	2.0e+02	+	1.9e+02	+	1.3e+02	+
	(5.6e+00)	(3.3e+01)		(7.4e+01)		(2.6e+01)	
f_{27}	3.3e+02	6.4e+02	+	4.0e+02	·	3.0e+02	−
	(4.4e+01)	(4.3e+01)		(1.0e+02)		(5.6e−03)	
f_{28}	3.1e+02	8.4e+02	+	3.0e+02	−	3.0e+02	−
	(1.7e+01)	(1.1e+02)		(5.1e+01)		(6.8e+00)	
Summary (+/·/−)		26/1/1		12/6/10		5/15/8	

Table 76: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	8.3e−02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.8e−01)		(0.0e+00)		(0.0e+00)	
f_2	4.6e+03	1.8e+05	+	1.6e+00	−	1.6e+02	−
	(1.2e+04)	(1.8e+05)		(5.1e+00)		(6.9e+02)	
f_3	5.1e+05	4.7e+05	+	1.2e−01	−	5.2e−02	−
	(1.6e+06)	(1.1e+06)		(8.8e−01)		(3.4e−01)	
f_4	3.5e−01	2.2e+03	+	0.0e+00	·	0.0e+00	·
	(2.1e+00)	(1.9e+03)		(0.0e+00)		(0.0e+00)	
f_5	3.6e+00	3.5e−01	·	0.0e+00	−	9.8e−03	−
	(1.4e+01)	(5.9e−01)		(0.0e+00)		(5.4e−02)	
f_6	7.7e+00	8.6e+00	·	7.7e+00	·	5.9e+00	·
	(9.7e+00)	(3.1e+00)		(1.2e+01)		(4.7e+00)	
f_7	4.1e+00	2.9e+00	·	1.5e+01	+	4.5e+00	·
	(5.9e+00)	(2.7e+00)		(1.7e+01)		(9.7e+00)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(7.7e−02)	(8.5e−02)		(9.8e−02)		(7.5e−02)	
f_9	2.3e+00	1.8e+00	·	3.3e+00	+	2.1e+00	·
	(1.3e+00)	(8.8e−01)		(1.5e+00)		(1.2e+00)	
f_{10}	1.0e−01	7.3e−01	+	2.0e−01	·	1.1e−01	·
	(6.0e−02)	(5.1e−01)		(1.9e−01)		(1.3e−01)	
f_{11}	4.6e+00	2.8e+00	·	1.3e+01	+	7.0e+00	·
	(3.1e+00)	(1.3e+00)		(6.1e+00)		(4.5e+00)	
f_{12}	9.0e+00	2.2e+01	+	1.9e+01	+	1.9e+01	+
	(3.2e+00)	(1.1e+01)		(8.9e+00)		(8.4e+00)	
f_{13}	1.5e+01	2.4e+01	+	3.2e+01	+	1.5e+01	·
	(8.5e+00)	(8.7e+00)		(1.2e+01)		(8.9e+00)	
f_{14}	2.8e+02	6.1e+01	−	4.3e+02	+	8.5e+02	+
	(1.7e+02)	(3.8e+01)		(1.8e+02)		(3.3e+02)	
f_{15}	7.8e+02	1.2e+03	+	1.2e+03	·	1.2e+03	+
	(3.7e+02)	(2.9e+02)		(3.2e+02)		(2.7e+02)	
f_{16}	8.8e−01	1.3e+00	+	1.6e+00	+	1.1e+00	+
	(1.6e−01)	(1.9e−01)		(4.8e−01)		(1.8e−01)	
f_{17}	1.7e+01	1.5e+01	−	2.2e+01	+	2.8e+01	+
	(3.0e+00)	(1.8e+00)		(7.0e+00)		(4.9e+00)	
f_{18}	2.7e+01	4.5e+01	+	4.2e+01	+	3.3e+01	+
	(4.5e+00)	(1.0e+01)		(1.3e+01)		(4.0e+00)	
f_{19}	7.6e−01	7.5e−01	·	1.0e+00	·	1.5e+00	+
	(2.7e−01)	(2.4e−01)		(4.2e−01)		(4.3e−01)	
f_{20}	2.4e+00	3.0e+00	+	3.4e+00	+	2.6e+00	·
	(6.0e−01)	(4.2e−01)		(4.2e−01)		(6.7e−01)	
f_{21}	3.9e+02	3.7e+02	+	3.7e+02	·	3.8e+02	·
	(5.7e+01)	(7.8e+01)		(7.8e+01)		(6.4e+01)	
f_{22}	3.1e+02	1.1e+02	−	5.1e+02	+	6.1e+02	+
	(1.5e+02)	(5.1e+01)		(2.0e+02)		(3.5e+02)	
f_{23}	5.9e+02	1.2e+03	+	1.3e+03	+	1.1e+03	+
	(3.6e+02)	(2.8e+02)		(4.0e+02)		(4.1e+02)	
f_{24}	2.0e+02	2.0e+02	·	2.1e+02	+	2.0e+02	·
	(2.0e+01)	(2.6e+01)		(2.1e+01)		(2.0e+01)	
f_{25}	2.0e+02	2.0e+02	·	2.1e+02	·	2.0e+02	·
	(1.9e+01)	(1.8e+01)		(1.9e+01)		(1.7e+01)	
f_{26}	1.7e+02	1.5e+02	−	2.0e+02	·	1.9e+02	·
	(4.9e+01)	(3.9e+01)		(6.9e+01)		(6.5e+01)	
f_{27}	3.4e+02	3.2e+02	+	4.1e+02	·	3.7e+02	·
	(7.6e+01)	(1.1e+01)		(1.1e+02)		(9.9e+01)	
f_{28}	3.3e+02	2.7e+02	·	3.2e+02	·	3.1e+02	·
	(1.2e+02)	(7.5e+01)		(9.0e+01)		(5.9e+01)	
Summary (+/·/−)		14/10/4		14/11/3		9/16/3	

Table 77: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	0.0e+00	0.0e+00	·	1.0e−09	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(7.1e−09)		(0.0e+00)	
f_3	2.1e−01	2.3e−01	·	2.8e+02	−	1.1e−01	·
	(2.2e−01)	(2.6e−01)		(1.5e+03)		(1.1e−01)	
f_4	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_5	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_6	1.1e+00	3.3e+00	·	4.1e+00	·	1.4e+00	·
	(2.6e+00)	(4.4e+00)		(4.7e+00)		(3.1e+00)	
f_7	1.3e−04	3.6e−05	−	9.0e+00	+	2.6e−03	+
	(1.6e−04)	(6.4e−05)		(9.0e+00)		(1.2e−03)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(6.8e−02)	(8.2e−02)		(1.0e−01)		(8.4e−02)	
f_9	5.2e−01	7.9e−01	·	3.4e+00	+	5.9e+00	+
	(7.8e−01)	(7.4e−01)		(2.1e+00)		(2.7e+00)	
f_{10}	3.3e−01	4.6e−02	−	2.9e−01	·	4.7e−01	+
	(1.4e−01)	(3.2e−02)		(2.1e−01)		(7.7e−02)	
f_{11}	1.7e+01	3.5e−01	−	1.1e+01	−	1.9e+01	+
	(2.9e+00)	(6.2e−01)		(5.0e+00)		(3.8e+00)	
f_{12}	2.6e+01	8.6e+00	−	2.4e+01	·	2.5e+01	·
	(3.5e+00)	(4.7e+00)		(1.3e+01)		(3.7e+00)	
f_{13}	2.4e+01	1.1e+01	−	3.4e+01	+	2.5e+01	·
	(4.0e+00)	(5.4e+00)		(1.0e+01)		(4.3e+00)	
f_{14}	1.0e+03	2.7e+01	−	4.5e+02	−	1.1e+03	+
	(1.4e+02)	(2.0e+01)		(2.3e+02)		(1.6e+02)	
f_{15}	1.3e+03	9.9e+02	−	1.5e+03	·	1.4e+03	·
	(1.7e+02)	(3.0e+02)		(3.2e+02)		(1.4e+02)	
f_{16}	1.1e+00	1.2e+00	·	1.7e+00	+	1.1e+00	·
	(1.6e−01)	(2.8e−01)		(4.6e−01)		(1.8e−01)	
f_{17}	3.0e+01	1.2e+01	−	2.4e+01	−	3.1e+01	·
	(2.7e+00)	(1.1e+00)		(7.2e+00)		(3.6e+00)	
f_{18}	3.5e+01	3.1e+01	−	4.8e+01	+	3.5e+01	·
	(3.6e+00)	(5.4e+00)		(1.0e+01)		(3.7e+00)	
f_{19}	1.9e+00	6.0e−01	−	1.3e+00	−	2.0e+00	·
	(3.4e−01)	(2.0e−01)		(4.7e−01)		(3.1e−01)	
f_{20}	2.5e+00	2.3e+00	·	3.4e+00	+	2.6e+00	·
	(2.3e−01)	(4.4e−01)		(4.3e−01)		(1.6e−01)	
f_{21}	4.0e+02	3.8e+02	·	3.6e+02	·	4.0e+02	·
	(2.8e+01)	(6.7e+01)		(8.5e+01)		(0.0e+00)	
f_{22}	1.0e+03	7.1e+01	−	4.8e+02	−	1.2e+03	+
	(1.7e+02)	(3.7e+01)		(2.3e+02)		(1.6e+02)	
f_{23}	1.2e+03	8.1e+02	−	1.5e+03	·	1.3e+03	·
	(1.8e+02)	(3.5e+02)		(4.9e+02)		(2.1e+02)	
f_{24}	2.0e+02	2.0e+02	·	2.1e+02	+	2.0e+02	·
	(3.5e+00)	(2.3e+01)		(5.4e+00)		(1.3e+00)	
f_{25}	2.0e+02	2.0e+02	−	2.1e+02	+	2.0e+02	+
	(1.3e+01)	(1.4e+01)		(1.4e+01)		(3.4e−03)	
f_{26}	1.5e+02	1.5e+02	·	1.9e+02	+	1.5e+02	·
	(3.5e+01)	(4.4e+01)		(6.0e+01)		(3.2e+01)	
f_{27}	3.2e+02	3.1e+02	−	3.6e+02	+	3.0e+02	+
	(5.0e+01)	(4.9e+01)		(8.7e+01)		(2.4e+01)	
f_{28}	2.9e+02	2.6e+02	·	2.9e+02	·	3.0e+02	+
	(3.9e+01)	(7.7e+01)		(6.1e+01)		(1.7e−13)	
Summary (+/·/−)		0/14/14		11/11/6		9/19/0	

Table 78: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	2.5e−01	1.3e−02	+	0.0e+00	·	0.0e+00	·
	(1.8e+00)	(7.2e−02)		(0.0e+00)		(0.0e+00)	
f_2	8.9e+03	3.0e+05	+	0.0e+00	−	0.0e+00	−
	(4.0e+04)	(3.6e+05)		(0.0e+00)		(0.0e+00)	
f_3	1.2e+07	1.8e+07	·	2.5e+04	−	8.8e−01	−
	(4.6e+07)	(7.3e+07)		(1.8e+05)		(4.7e+00)	
f_4	5.0e+00	5.1e+03	+	0.0e+00	−	0.0e+00	−
	(1.9e+01)	(2.8e+03)		(0.0e+00)		(0.0e+00)	
f_5	1.4e+01	2.7e−01	−	0.0e+00	−	0.0e+00	−
	(2.3e+01)	(1.4e+00)		(0.0e+00)		(0.0e+00)	
f_6	9.6e+00	7.5e+00	·	5.5e+00	−	4.7e+00	−
	(1.3e+01)	(3.8e+00)		(4.9e+00)		(4.9e+00)	
f_7	1.1e+00	5.2e−01	·	8.5e+00	+	3.4e−01	−
	(2.6e+00)	(1.1e+00)		(1.2e+01)		(2.0e+00)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(6.9e−02)	(8.5e−02)		(1.0e−01)		(7.6e−02)	
f_9	1.4e+00	1.6e+00	·	3.0e+00	+	1.5e+00	·
	(8.1e−01)	(8.7e−01)		(1.6e+00)		(9.6e−01)	
f_{10}	1.9e−01	1.7e−01	+	2.2e−01	+	4.9e−01	+
	(4.6e−01)	(1.6e−01)		(1.8e−01)		(1.1e−01)	
f_{11}	1.9e+00	7.5e−01	·	1.3e+01	+	2.0e+01	+
	(1.5e+00)	(7.2e−01)		(6.1e+00)		(4.8e+00)	
f_{12}	4.8e+00	7.7e+00	+	1.8e+01	+	2.7e+01	+
	(2.2e+00)	(3.3e+00)		(8.7e+00)		(4.1e+00)	
f_{13}	8.3e+00	1.1e+01	+	3.1e+01	+	2.4e+01	+
	(4.4e+00)	(4.3e+00)		(1.4e+01)		(5.0e+00)	
f_{14}	6.2e+02	2.5e+01	−	5.1e+02	·	1.0e+03	+
	(2.9e+02)	(2.4e+01)		(2.2e+02)		(2.3e+02)	
f_{15}	1.1e+03	5.0e+02	−	1.3e+03	·	1.4e+03	+
	(1.7e+02)	(2.8e+02)		(3.4e+02)		(2.1e+02)	
f_{16}	8.9e−01	1.3e+00	+	1.5e+00	+	1.2e+00	+
	(1.7e−01)	(2.5e−01)		(3.9e−01)		(2.2e−01)	
f_{17}	1.7e+01	1.3e+01	−	2.3e+01	+	3.2e+01	+
	(2.0e+00)	(1.1e+00)		(8.1e+00)		(3.7e+00)	
f_{18}	2.5e+01	3.7e+01	+	4.5e+01	+	3.4e+01	+
	(4.5e+00)	(7.2e+00)		(8.6e+00)		(4.9e+00)	
f_{19}	1.1e+00	6.1e−01	−	1.1e+00	·	1.9e+00	+
	(3.5e−01)	(1.8e−01)		(4.0e−01)		(4.0e−01)	
f_{20}	2.3e+00	2.7e+00	·	3.3e+00	+	2.7e+00	·
	(6.3e−01)	(6.0e−01)		(4.7e−01)		(5.9e−01)	
f_{21}	4.0e+02	3.6e+02	+	3.7e+02	·	3.8e+02	·
	(4.1e−05)	(8.4e+01)		(7.0e+01)		(6.7e+01)	
f_{22}	3.9e+02	7.8e+01	−	4.5e+02	·	9.4e+02	+
	(3.0e+02)	(5.1e+01)		(1.9e+02)		(3.0e+02)	
f_{23}	7.5e+02	5.3e+02	·	1.3e+03	+	1.3e+03	+
	(3.7e+02)	(2.6e+02)		(3.8e+02)		(2.3e+02)	
f_{24}	2.0e+02	2.0e+02	·	2.1e+02	·	2.1e+02	·
	(1.4e+01)	(2.9e+01)		(1.1e+01)		(1.2e+01)	
f_{25}	2.0e+02	2.0e+02	·	2.1e+02	+	2.1e+02	·
	(5.0e+00)	(1.8e+01)		(5.6e+00)		(4.9e+00)	
f_{26}	1.6e+02	1.6e+02	·	1.9e+02	·	1.9e+02	·
	(5.2e+01)	(4.6e+01)		(7.1e+01)		(6.5e+01)	
f_{27}	3.2e+02	3.2e+02	+	4.0e+02	+	3.7e+02	·
	(5.2e+01)	(4.6e+01)		(1.0e+02)		(9.4e+01)	
f_{28}	3.3e+02	2.6e+02	·	3.2e+02	·	2.9e+02	·
	(9.2e+01)	(8.5e+01)		(1.2e+02)		(5.9e+01)	
Summary (+/·/−)		10/12/6		14/9/5		12/10/6	

Table 79: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	3.7e+00	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(8.5e+00)		(0.0e+00)	
f_2	0.0e+00	0.0e+00	·	9.3e+03	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(4.0e+04)		(0.0e+00)	
f_3	2.0e+01	2.0e+00	·	2.6e+07	+	2.0e−01	·
	(1.1e+02)	(7.8e+00)		(6.6e+07)		(1.9e−01)	
f_4	0.0e+00	0.0e+00	·	3.5e+02	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(6.6e+02)		(0.0e+00)	
f_5	0.0e+00	0.0e+00	·	2.7e−01	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(5.8e−01)		(0.0e+00)	
f_6	3.8e−01	5.5e−01	·	3.4e+00	·	2.7e−02	−
	(7.7e−01)	(1.5e+00)		(4.3e+00)		(6.2e−02)	
f_7	1.0e−02	2.8e−04	·	3.5e+01	+	1.1e−03	+
	(4.4e−02)	(8.4e−04)		(2.2e+01)		(1.3e−03)	
f_8	2.0e+01	2.1e+01	·	2.1e+01	+	2.0e+01	−
	(9.8e−02)	(9.3e−02)		(1.2e−01)		(7.6e−02)	
f_9	1.3e+00	1.2e+00	·	8.2e+00	+	4.1e+00	+
	(1.1e+00)	(1.4e+00)		(2.6e+00)		(3.2e+00)	
f_{10}	2.2e−01	1.8e−01	·	4.3e+00	+	4.1e−01	+
	(1.4e−01)	(1.1e−01)		(8.2e+00)		(7.1e−02)	
f_{11}	2.6e+01	2.9e+01	·	4.1e+01	·	2.5e+01	·
	(7.0e+00)	(8.0e+00)		(2.5e+01)		(3.5e+00)	
f_{12}	2.8e+01	2.9e+01	·	3.5e+01	·	2.4e+01	·
	(7.7e+00)	(6.2e+00)		(2.3e+01)		(3.9e+00)	
f_{13}	2.9e+01	3.1e+01	·	5.6e+01	+	2.5e+01	·
	(7.0e+00)	(7.3e+00)		(1.6e+01)		(4.2e+00)	
f_{14}	1.6e+03	1.6e+03	·	2.0e+03	+	1.3e+03	−
	(2.0e+02)	(2.2e+02)		(2.9e+02)		(1.2e+02)	
f_{15}	1.6e+03	1.6e+03	·	2.0e+03	+	1.3e+03	−
	(2.0e+02)	(1.6e+02)		(2.4e+02)		(1.3e+02)	
f_{16}	1.3e+00	1.4e+00	·	2.2e+00	+	1.2e+00	·
	(3.0e−01)	(2.7e−01)		(4.5e−01)		(1.6e−01)	
f_{17}	4.1e+01	4.2e+01	·	6.1e+01	+	3.8e+01	·
	(5.3e+00)	(5.4e+00)		(2.5e+01)		(3.4e+00)	
f_{18}	4.0e+01	4.1e+01	·	7.6e+01	+	3.5e+01	−
	(6.4e+00)	(5.1e+00)		(1.8e+01)		(3.8e+00)	
f_{19}	2.7e+00	2.7e+00	·	3.5e+00	·	2.1e+00	−
	(5.2e−01)	(5.3e−01)		(2.0e+00)		(2.9e−01)	
f_{20}	3.0e+00	3.1e+00	·	4.0e+00	+	2.5e+00	−
	(3.0e−01)	(3.5e−01)		(2.6e−01)		(2.0e−01)	
f_{21}	3.3e+02	3.2e+02	·	3.7e+02	+	4.0e+02	·
	(1.0e+02)	(1.0e+02)		(7.5e+01)		(0.0e+00)	
f_{22}	1.6e+03	1.6e+03	·	2.1e+03	+	1.4e+03	−
	(2.0e+02)	(2.9e+02)		(4.6e+02)		(1.9e+02)	
f_{23}	1.6e+03	1.6e+03	·	2.0e+03	+	1.4e+03	−
	(2.6e+02)	(2.4e+02)		(3.9e+02)		(1.7e+02)	
f_{24}	2.0e+02	2.0e+02	·	2.2e+02	+	2.0e+02	·
	(1.9e+01)	(2.2e+01)		(1.2e+01)		(1.6e+00)	
f_{25}	2.0e+02	2.0e+02	·	2.2e+02	+	2.0e+02	·
	(1.3e+01)	(1.8e+01)		(1.3e+01)		(6.4e−01)	
f_{26}	1.6e+02	1.5e+02	·	1.9e+02	·	1.5e+02	·
	(3.6e+01)	(3.7e+01)		(6.0e+01)		(3.3e+01)	
f_{27}	3.1e+02	3.1e+02	·	5.1e+02	+	3.0e+02	+
	(3.4e+01)	(4.5e+01)		(8.2e+01)		(3.2e−04)	
f_{28}	2.5e+02	2.5e+02	·	4.0e+02	+	3.0e+02	+
	(9.0e+01)	(8.8e+01)		(1.8e+02)		(2.6e−13)	
Summary (+/·/−)		0/28/0		23/5/0		5/14/9	

Table 80: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	1.5e+03	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(8.3e+02)		(0.0e+00)	
f_2	0.0e+00	0.0e+00	·	1.1e+07	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(5.4e+06)		(0.0e+00)	
f_3	5.9e−01	1.5e−01	−	3.3e+09	+	2.8e+03	+
	(1.3e+00)	(8.8e−01)		(2.0e+09)		(6.2e+03)	
f_4	0.0e+00	0.0e+00	·	2.6e+04	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(1.3e+04)		(0.0e+00)	
f_5	0.0e+00	0.0e+00	·	1.3e+02	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(9.3e+01)		(0.0e+00)	
f_6	0.0e+00	0.0e+00	·	9.8e+01	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(5.4e+01)		(0.0e+00)	
f_7	3.4e−01	2.6e−02	−	9.7e+01	+	1.6e+00	+
	(1.8e−01)	(1.5e−01)		(3.0e+01)		(5.6e−01)	
f_8	2.0e+01	2.0e+01	+	2.1e+01	+	2.0e+01	·
	(7.8e−02)	(1.1e−01)		(1.3e−01)		(6.7e−02)	
f_9	7.2e+00	4.9e+00	−	1.1e+01	+	8.4e+00	+
	(1.6e+00)	(3.5e+00)		(1.0e+00)		(6.4e−01)	
f_{10}	5.1e−01	3.5e−01	·	1.7e+02	+	5.3e−01	·
	(7.7e−02)	(2.7e−01)		(7.7e+01)		(6.3e−02)	
f_{11}	3.1e+01	3.2e+01	·	8.3e+01	+	3.2e+01	·
	(4.6e+00)	(1.4e+01)		(1.6e+01)		(5.6e+00)	
f_{12}	3.0e+01	3.4e+01	+	9.0e+01	+	3.3e+01	·
	(4.4e+00)	(1.4e+01)		(1.6e+01)		(3.0e+00)	
f_{13}	3.3e+01	3.3e+01	·	9.4e+01	+	3.2e+01	·
	(3.8e+00)	(1.2e+01)		(1.6e+01)		(4.5e+00)	
f_{14}	1.5e+03	1.6e+03	+	1.9e+03	+	1.4e+03	·
	(1.4e+02)	(2.2e+02)		(3.0e+02)		(1.6e+02)	
f_{15}	1.4e+03	1.6e+03	+	2.0e+03	+	1.4e+03	·
	(1.3e+02)	(1.8e+02)		(2.8e+02)		(1.2e+02)	
f_{16}	1.1e+00	1.6e+00	+	2.2e+00	+	1.2e+00	·
	(1.9e−01)	(3.2e−01)		(5.3e−01)		(1.9e−01)	
f_{17}	4.2e+01	5.0e+01	+	1.7e+02	+	4.3e+01	·
	(5.6e+00)	(7.1e+00)		(3.4e+01)		(4.8e+00)	
f_{18}	4.4e+01	4.9e+01	·	1.7e+02	+	4.4e+01	·
	(4.3e+00)	(9.5e+00)		(3.0e+01)		(4.1e+00)	
f_{19}	2.6e+00	3.1e+00	·	6.5e+01	+	2.5e+00	·
	(3.8e−01)	(6.6e−01)		(6.9e+01)		(4.6e−01)	
f_{20}	2.9e+00	3.4e+00	+	4.3e+00	+	3.0e+00	·
	(2.4e−01)	(2.4e−01)		(2.0e−01)		(2.4e−01)	
f_{21}	3.1e+02	3.3e+02	·	5.6e+02	+	3.9e+02	·
	(1.0e+02)	(9.8e+01)		(7.1e+01)		(3.9e+01)	
f_{22}	1.5e+03	1.8e+03	+	2.1e+03	+	1.6e+03	·
	(1.3e+02)	(1.9e+02)		(2.9e+02)		(1.5e+02)	
f_{23}	1.4e+03	1.7e+03	+	2.3e+03	+	1.5e+03	·
	(1.6e+02)	(2.7e+02)		(2.7e+02)		(1.5e+02)	
f_{24}	2.0e+02	1.9e+02	·	2.3e+02	+	2.1e+02	+
	(1.7e+01)	(2.6e+01)		(5.0e+00)		(4.9e+00)	
f_{25}	2.0e+02	2.0e+02	−	2.3e+02	+	2.0e+02	·
	(1.0e+01)	(8.8e+00)		(5.3e+00)		(2.5e+00)	
f_{26}	1.6e+02	1.6e+02	·	2.0e+02	+	1.7e+02	·
	(3.5e+01)	(3.8e+01)		(2.8e+01)		(3.2e+01)	
f_{27}	3.0e+02	3.1e+02	−	6.6e+02	+	3.0e+02	+
	(2.4e+01)	(4.0e+01)		(3.3e+01)		(6.4e−01)	
f_{28}	2.5e+02	2.6e+02	−	9.0e+02	+	3.0e+02	−
	(8.8e+01)	(8.0e+01)		(1.8e+02)		(3.5e−08)	
Summary (+/·/−)		9/13/6		28/0/0		5/22/1	

Table 81: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	6.4e+01	3.6e−01	−	1.1e+02	·	4.4e+01	·
	(8.8e+01)	(2.6e+00)		(1.9e+02)		(6.7e+01)	
f_2	2.4e+06	3.5e+05	−	2.1e+06	·	2.1e+06	·
	(2.8e+06)	(1.4e+06)		(2.4e+06)		(2.8e+06)	
f_3	1.1e+09	7.0e+07	−	1.1e+09	·	2.5e+08	−
	(1.5e+09)	(2.2e+08)		(2.2e+09)		(4.7e+08)	
f_4	8.4e+03	6.7e+03	·	1.1e+04	·	5.4e+03	−
	(6.1e+03)	(8.0e+03)		(7.2e+03)		(4.4e+03)	
f_5	1.4e+02	2.1e−03	−	1.4e+02	·	7.2e+01	·
	(1.4e+02)	(6.2e−03)		(1.4e+02)		(4.4e+01)	
f_6	4.1e+01	5.8e+00	−	4.2e+01	·	4.4e+01	·
	(3.4e+01)	(7.1e+00)		(3.4e+01)		(3.2e+01)	
f_7	6.1e+01	3.4e+01	·	6.6e+01	·	4.6e+01	−
	(3.6e+01)	(2.8e+01)		(3.4e+01)		(3.3e+01)	
f_8	2.1e+01	2.0e+01	−	2.1e+01	·	2.0e+01	−
	(1.2e−01)	(1.1e−01)		(8.6e−02)		(6.1e−02)	
f_9	5.4e+00	8.8e+00	+	5.0e+00	·	4.3e+00	·
	(1.4e+00)	(1.4e+00)		(1.5e+00)		(1.3e+00)	
f_{10}	3.7e+01	2.2e+00	−	4.5e+01	·	2.3e+01	−
	(3.2e+01)	(9.9e+00)		(5.8e+01)		(3.7e+01)	
f_{11}	3.5e+01	4.4e+01	·	3.0e+01	·	2.5e+01	−
	(1.3e+01)	(2.1e+01)		(1.4e+01)		(1.0e+01)	
f_{12}	3.3e+01	3.8e+01	·	3.1e+01	·	2.4e+01	−
	(1.5e+01)	(2.4e+01)		(1.5e+01)		(1.1e+01)	
f_{13}	5.0e+01	4.9e+01	·	4.9e+01	·	4.2e+01	·
	(1.8e+01)	(1.8e+01)		(2.0e+01)		(1.5e+01)	
f_{14}	1.4e+03	1.6e+03	·	1.4e+03	·	5.7e+02	−
	(5.0e+02)	(2.4e+02)		(4.8e+02)		(2.7e+02)	
f_{15}	1.4e+03	1.7e+03	+	1.4e+03	·	5.3e+02	−
	(4.3e+02)	(1.5e+02)		(4.6e+02)		(2.0e+02)	
f_{16}	2.0e+00	1.6e+00	−	1.9e+00	·	1.1e+00	−
	(4.1e−01)	(2.9e−01)		(4.6e−01)		(2.2e−01)	
f_{17}	6.9e+01	5.4e+01	−	6.2e+01	·	3.9e+01	−
	(1.7e+01)	(1.0e+01)		(1.7e+01)		(1.5e+01)	
f_{18}	6.5e+01	5.6e+01	−	6.7e+01	·	4.2e+01	−
	(1.6e+01)	(1.1e+01)		(2.0e+01)		(1.4e+01)	
f_{19}	2.8e+00	3.5e+00	·	2.7e+00	·	1.4e+00	−
	(1.7e+00)	(9.2e−01)		(2.2e+00)		(7.6e−01)	
f_{20}	3.7e+00	4.0e+00	+	3.6e+00	·	3.2e+00	−
	(3.9e−01)	(2.0e−01)		(3.7e−01)		(5.4e−01)	
f_{21}	3.9e+02	3.3e+02	−	3.8e+02	·	3.7e+02	·
	(6.7e+01)	(1.0e+02)		(7.4e+01)		(7.2e+01)	
f_{22}	1.5e+03	1.9e+03	+	1.6e+03	·	7.9e+02	−
	(4.8e+02)	(1.8e+02)		(4.7e+02)		(3.1e+02)	
f_{23}	1.6e+03	1.8e+03	+	1.6e+03	·	8.4e+02	−
	(4.6e+02)	(1.8e+02)		(5.7e+02)		(2.7e+02)	
f_{24}	2.2e+02	2.2e+02	+	2.2e+02	·	2.1e+02	·
	(1.9e+01)	(6.4e+00)		(1.7e+01)		(1.8e+01)	
f_{25}	2.2e+02	2.2e+02	·	2.2e+02	·	2.2e+02	·
	(5.6e+00)	(1.4e+01)		(5.0e+00)		(4.8e+00)	
f_{26}	2.2e+02	1.8e+02	·	2.2e+02	·	2.2e+02	·
	(7.2e+01)	(2.7e+01)		(7.2e+01)		(7.2e+01)	
f_{27}	5.4e+02	5.1e+02	·	5.3e+02	·	4.9e+02	·
	(7.2e+01)	(1.2e+02)		(6.9e+01)		(7.0e+01)	
f_{28}	6.0e+02	2.6e+02	−	6.1e+02	·	5.3e+02	·
	(1.5e+02)	(8.3e+01)		(1.5e+02)		(1.7e+02)	
Summary (+/·/−)		6/10/12		0/28/0		0/12/16	

Table 82: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	1.5e+04	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(3.7e+03)		(0.0e+00)		(0.0e+00)	
f_2	1.8e+01	1.6e+08	+	1.1e+04	·	2.6e+02	·
	(7.2e+01)	(9.1e+07)		(4.1e+04)		(1.7e+03)	
f_3	5.6e−01	2.5e+13	+	3.7e+06	+	2.5e+04	·
	(2.8e+00)	(8.5e+13)		(2.5e+07)		(1.8e+05)	
f_4	0.0e+00	2.2e+06	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(4.2e+06)		(0.0e+00)		(0.0e+00)	
f_5	0.0e+00	8.1e+03	+	2.3e+00	·	0.0e+00	·
	(0.0e+00)	(5.4e+03)		(1.6e+01)		(0.0e+00)	
f_6	4.8e+00	1.4e+03	+	5.0e+00	·	4.9e+00	·
	(1.2e+01)	(5.1e+02)		(4.6e+00)		(1.2e+01)	
f_7	2.6e+00	4.5e+03	+	2.3e+01	+	7.5e−01	−
	(7.8e+00)	(1.2e+04)		(2.1e+01)		(2.6e+00)	
f_8	2.0e+01	2.1e+01	+	2.1e+01	+	2.0e+01	·
	(7.4e−02)	(1.4e−01)		(1.0e−01)		(7.2e−02)	
f_9	2.1e+00	1.3e+01	+	4.5e+00	+	1.6e+00	·
	(1.2e+00)	(1.2e+00)		(2.6e+00)		(9.4e−01)	
f_{10}	1.5e−01	1.6e+03	+	7.3e−01	+	2.6e−01	·
	(1.3e−01)	(5.8e+02)		(2.8e−01)		(1.8e−01)	
f_{11}	1.2e+01	2.4e+02	+	5.0e+01	+	2.8e+01	+
	(5.2e+00)	(5.0e+01)		(1.3e+01)		(5.6e+00)	
f_{12}	1.2e+01	2.5e+02	+	4.9e+01	+	2.9e+01	+
	(7.8e+00)	(4.8e+01)		(1.1e+01)		(4.8e+00)	
f_{13}	1.8e+01	2.4e+02	+	5.1e+01	+	2.4e+01	+
	(9.4e+00)	(5.0e+01)		(1.1e+01)		(6.3e+00)	
f_{14}	7.3e+02	2.6e+03	+	1.9e+03	+	1.3e+03	+
	(4.7e+02)	(2.6e+02)		(2.4e+02)		(2.1e+02)	
f_{15}	1.1e+03	2.6e+03	+	2.0e+03	+	1.3e+03	·
	(4.4e+02)	(2.5e+02)		(2.7e+02)		(1.8e+02)	
f_{16}	9.0e−01	4.0e+00	+	2.2e+00	+	1.2e+00	+
	(2.0e−01)	(9.2e−01)		(4.8e−01)		(1.8e−01)	
f_{17}	3.4e+01	4.4e+02	+	6.4e+01	+	3.7e+01	·
	(7.4e+00)	(7.4e+01)		(1.3e+01)		(5.3e+00)	
f_{18}	3.3e+01	4.4e+02	+	6.5e+01	+	3.9e+01	+
	(7.4e+00)	(8.0e+01)		(1.2e+01)		(5.8e+00)	
f_{19}	1.6e+00	1.3e+05	+	3.7e+00	+	2.0e+00	+
	(8.4e−01)	(1.4e+05)		(8.4e−01)		(5.1e−01)	
f_{20}	2.5e+00	5.0e+00	+	3.9e+00	+	2.6e+00	·
	(5.8e−01)	(7.3e−02)		(3.2e−01)		(6.0e−01)	
f_{21}	3.7e+02	1.1e+03	+	3.7e+02	·	3.6e+02	·
	(8.1e+01)	(1.8e+02)		(7.2e+01)		(9.5e+01)	
f_{22}	8.3e+02	2.9e+03	+	2.0e+03	+	1.3e+03	+
	(4.6e+02)	(2.3e+02)		(3.8e+02)		(2.8e+02)	
f_{23}	7.7e+02	2.9e+03	+	2.1e+03	+	1.3e+03	+
	(5.1e+02)	(2.4e+02)		(2.2e+02)		(2.8e+02)	
f_{24}	2.1e+02	2.5e+02	+	2.1e+02	+	2.1e+02	·
	(6.1e+00)	(8.3e+00)		(6.9e+00)		(4.8e+00)	
f_{25}	2.0e+02	2.5e+02	+	2.1e+02	+	2.0e+02	·
	(1.9e+01)	(5.9e+00)		(1.4e+01)		(1.6e+01)	
f_{26}	2.0e+02	3.1e+02	+	2.1e+02	+	2.0e+02	·
	(7.8e+01)	(4.5e+01)		(6.3e+01)		(6.9e+01)	
f_{27}	3.8e+02	9.8e+02	+	4.5e+02	·	3.5e+02	−
	(9.6e+01)	(1.1e+02)		(8.8e+01)		(8.9e+01)	
f_{28}	3.0e+02	1.7e+03	+	3.1e+02	+	3.1e+02	·
	(6.9e+01)	(2.0e+02)		(5.2e+01)		(7.3e+01)	
Summary (+/·/−)		28/0/0		21/7/0		9/17/2	

Table 83: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.0e+02	1.4e+04	+	0.0e+00	−	1.3e+02	·
	(2.9e+02)	(3.5e+03)		(0.0e+00)		(2.7e+02)	
f_2	2.1e+05	1.5e+08	+	1.7e+03	−	2.7e+05	·
	(2.6e+05)	(8.3e+07)		(5.5e+03)		(3.4e+05)	
f_3	1.2e+08	5.2e+13	+	3.5e+04	−	3.9e+08	+
	(1.8e+08)	(2.5e+14)		(8.0e+04)		(4.2e+08)	
f_4	1.0e+03	1.0e+06	+	6.2e+00	−	1.1e+03	·
	(8.6e+02)	(1.8e+06)		(4.5e+01)		(9.9e+02)	
f_5	2.2e+01	7.1e+03	+	3.8e−09	−	4.6e+01	·
	(2.4e+01)	(4.0e+03)		(2.5e−08)		(6.3e+01)	
f_6	1.2e+01	1.3e+03	+	7.1e+00	·	1.8e+01	·
	(1.0e+01)	(6.5e+02)		(1.5e+01)		(2.2e+01)	
f_7	4.5e−01	9.0e+03	+	2.6e+01	+	8.0e−01	·
	(7.5e−01)	(3.3e+04)		(2.7e+01)		(1.2e+00)	
f_8	2.0e+01	2.1e+01	+	2.1e+01	+	2.0e+01	·
	(7.8e−02)	(1.2e−01)		(1.1e−01)		(6.1e−02)	
f_9	1.2e+00	1.3e+01	+	4.1e+00	+	9.0e−01	·
	(6.6e−01)	(9.7e−01)		(2.3e+00)		(6.0e−01)	
f_{10}	1.0e+01	1.7e+03	+	6.9e−01	·	1.1e+01	·
	(1.7e+01)	(6.0e+02)		(2.6e−01)		(1.9e+01)	
f_{11}	1.2e+01	2.3e+02	+	4.8e+01	+	1.8e+01	+
	(4.3e+00)	(4.8e+01)		(1.5e+01)		(4.4e+00)	
f_{12}	1.2e+01	2.5e+02	+	5.0e+01	+	2.0e+01	+
	(5.0e+00)	(4.4e+01)		(1.3e+01)		(5.5e+00)	
f_{13}	1.3e+01	2.5e+02	+	5.3e+01	+	1.6e+01	·
	(6.9e+00)	(4.8e+01)		(1.3e+01)		(5.9e+00)	
f_{14}	1.3e+03	2.7e+03	+	1.9e+03	+	1.2e+03	·
	(1.7e+02)	(2.3e+02)		(3.0e+02)		(1.6e+02)	
f_{15}	1.1e+03	2.6e+03	+	1.9e+03	+	1.1e+03	·
	(1.4e+02)	(2.9e+02)		(2.5e+02)		(1.3e+02)	
f_{16}	7.5e−01	4.0e+00	+	2.2e+00	+	1.2e+00	+
	(1.3e−01)	(9.1e−01)		(4.2e−01)		(2.0e−01)	
f_{17}	2.3e+01	4.2e+02	+	6.5e+01	+	2.9e+01	+
	(2.8e+00)	(7.2e+01)		(1.5e+01)		(3.6e+00)	
f_{18}	2.4e+01	4.1e+02	+	6.3e+01	+	2.9e+01	+
	(3.4e+00)	(8.7e+01)		(1.0e+01)		(3.9e+00)	
f_{19}	1.6e+00	6.8e+04	+	3.9e+00	+	1.5e+00	·
	(3.3e−01)	(6.0e+04)		(1.0e+00)		(4.2e−01)	
f_{20}	2.3e+00	4.9e+00	+	3.9e+00	+	2.2e+00	·
	(4.2e−01)	(1.4e−01)		(2.8e−01)		(5.0e−01)	
f_{21}	4.0e+02	1.2e+03	+	3.7e+02	−	4.0e+02	−
	(7.2e−01)	(2.2e+02)		(7.4e+01)		(3.9e−01)	
f_{22}	1.1e+03	2.9e+03	+	2.0e+03	+	9.6e+02	−
	(2.3e+02)	(2.8e+02)		(3.2e+02)		(2.9e+02)	
f_{23}	1.1e+03	2.9e+03	+	2.1e+03	+	7.5e+02	−
	(2.4e+02)	(2.4e+02)		(3.3e+02)		(2.2e+02)	
f_{24}	1.9e+02	2.5e+02	+	2.1e+02	+	2.0e+02	+
	(3.0e+01)	(7.5e+00)		(4.3e+00)		(3.1e+00)	
f_{25}	2.0e+02	2.5e+02	+	2.1e+02	+	2.0e+02	·
	(1.8e+00)	(4.3e+00)		(5.7e+00)		(7.7e−01)	
f_{26}	1.2e+02	3.2e+02	+	2.1e+02	+	1.3e+02	+
	(2.3e+01)	(4.0e+01)		(6.1e+01)		(2.9e+01)	
f_{27}	3.7e+02	9.8e+02	+	4.5e+02	+	3.2e+02	−
	(4.6e+01)	(1.1e+02)		(9.2e+01)		(3.2e+01)	
f_{28}	4.0e+02	1.6e+03	+	3.2e+02	−	4.4e+02	·
	(7.2e+01)	(2.1e+02)		(9.1e+01)		(7.1e+01)	
Summary (+/·/−)		28/0/0		19/2/7		8/16/4	

Table 84: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	2.1e+00	1.6e+00	+	7.5e−01	·	7.9e−02	·
	(1.0e+01)	(4.5e+00)		(3.9e+00)		(5.1e−01)	
f_2	4.4e+05	3.0e+05	·	1.4e+05	·	9.1e+04	−
	(7.3e+05)	(6.5e+05)		(2.8e+05)		(1.6e+05)	
f_3	6.1e+07	1.1e+07	·	3.6e+07	·	2.3e+07	·
	(2.3e+08)	(2.5e+07)		(9.0e+07)		(1.2e+08)	
f_4	1.4e+03	2.9e+03	+	1.3e+03	·	5.7e+02	·
	(1.7e+03)	(2.4e+03)		(2.3e+03)		(1.3e+03)	
f_5	2.9e+01	3.0e+00	−	2.4e+01	·	1.0e+01	−
	(2.6e+01)	(7.5e+00)		(3.0e+01)		(1.9e+01)	
f_6	1.5e+01	7.8e+00	·	1.2e+01	·	1.1e+01	·
	(2.0e+01)	(4.5e+00)		(1.7e+01)		(1.9e+01)	
f_7	1.1e+01	1.5e+00	−	3.9e+01	+	1.0e+01	·
	(1.2e+01)	(2.4e+00)		(3.5e+01)		(1.2e+01)	
f_8	2.0e+01	2.0e+01	+	2.1e+01	+	2.0e+01	·
	(8.5e−02)	(9.2e−02)		(1.1e−01)		(8.5e−02)	
f_9	2.9e+00	2.9e+00	·	4.7e+00	+	2.6e+00	·
	(1.2e+00)	(1.5e+00)		(1.5e+00)		(1.1e+00)	
f_{10}	2.2e+00	6.0e−01	·	1.9e+00	·	4.1e−01	·
	(5.7e+00)	(1.2e+00)		(4.2e+00)		(1.2e+00)	
f_{11}	1.2e+01	2.3e+01	+	3.8e+01	+	1.3e+01	·
	(5.4e+00)	(1.1e+01)		(1.3e+01)		(6.6e+00)	
f_{12}	1.1e+01	2.2e+01	+	3.6e+01	+	1.2e+01	·
	(5.1e+00)	(1.0e+01)		(1.5e+01)		(5.2e+00)	
f_{13}	2.1e+01	2.9e+01	+	4.6e+01	+	2.2e+01	·
	(9.1e+00)	(9.9e+00)		(1.7e+01)		(9.7e+00)	
f_{14}	6.6e+02	1.5e+03	+	1.6e+03	+	8.0e+02	·
	(3.6e+02)	(3.0e+02)		(4.3e+02)		(4.8e+02)	
f_{15}	6.5e+02	1.6e+03	+	1.9e+03	+	9.5e+02	+
	(3.2e+02)	(1.5e+02)		(3.0e+02)		(4.1e+02)	
f_{16}	6.7e−01	1.6e+00	+	2.3e+00	+	1.1e+00	+
	(1.6e−01)	(2.6e−01)		(5.2e−01)		(2.0e−01)	
f_{17}	2.4e+01	4.7e+01	+	6.1e+01	+	3.5e+01	+
	(6.1e+00)	(8.9e+00)		(1.0e+01)		(4.4e+00)	
f_{18}	2.7e+01	4.8e+01	+	6.5e+01	+	3.5e+01	+
	(5.5e+00)	(9.1e+00)		(9.9e+00)		(5.2e+00)	
f_{19}	8.4e−01	1.8e+00	+	3.5e+00	+	9.8e−01	·
	(2.9e−01)	(7.2e−01)		(1.1e+00)		(3.9e−01)	
f_{20}	2.5e+00	3.5e+00	+	3.8e+00	+	2.8e+00	·
	(8.1e−01)	(2.8e−01)		(3.0e−01)		(6.0e−01)	
f_{21}	4.0e+02	3.4e+02	·	3.7e+02	·	3.8e+02	−
	(1.4e+01)	(9.1e+01)		(6.9e+01)		(5.6e+01)	
f_{22}	6.2e+02	1.6e+03	+	1.9e+03	+	5.3e+02	·
	(2.7e+02)	(3.0e+02)		(5.0e+02)		(4.2e+02)	
f_{23}	6.2e+02	1.7e+03	+	2.0e+03	+	6.0e+02	·
	(3.8e+02)	(2.3e+02)		(3.8e+02)		(4.9e+02)	
f_{24}	2.1e+02	2.1e+02	·	2.1e+02	+	2.1e+02	·
	(5.5e+00)	(9.7e+00)		(5.4e+00)		(5.1e+00)	
f_{25}	2.1e+02	2.0e+02	·	2.1e+02	+	2.1e+02	·
	(1.5e+01)	(1.9e+01)		(1.0e+01)		(1.5e+01)	
f_{26}	1.8e+02	1.7e+02	·	2.2e+02	·	2.1e+02	·
	(7.1e+01)	(3.5e+01)		(6.9e+01)		(7.5e+01)	
f_{27}	3.7e+02	3.5e+02	·	4.7e+02	+	3.9e+02	·
	(8.7e+01)	(4.9e+01)		(8.3e+01)		(8.6e+01)	
f_{28}	3.6e+02	3.1e+02	·	3.4e+02	·	3.5e+02	·
	(1.5e+02)	(1.1e+02)		(1.4e+02)		(1.1e+02)	
Summary (+/·/−)		15/11/2		18/10/0		4/21/3	

Table 85: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	1.3e+00	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(5.5e+00)		(0.0e+00)	
f_2	0.0e+00	3.9e+00	·	5.4e+03	+	0.0e+00	·
	(0.0e+00)	(2.7e+01)		(3.5e+04)		(0.0e+00)	
f_3	1.0e+02	2.0e+04	+	9.5e+07	+	2.9e−01	·
	(6.0e+02)	(6.0e+04)		(5.4e+08)		(3.0e−01)	
f_4	0.0e+00	2.9e−02	·	2.7e+02	+	0.0e+00	·
	(0.0e+00)	(2.0e−01)		(9.8e+02)		(0.0e+00)	
f_5	0.0e+00	6.4e−05	·	6.0e−01	+	0.0e+00	·
	(0.0e+00)	(4.2e−04)		(2.0e+00)		(0.0e+00)	
f_6	7.3e−01	1.0e+00	·	3.0e+00	·	2.6e−01	·
	(1.9e+00)	(2.2e+00)		(4.2e+00)		(3.4e−01)	
f_7	7.6e−05	9.6e−03	+	3.3e+01	+	1.9e−04	+
	(3.1e−04)	(4.1e−02)		(2.2e+01)		(1.6e−04)	
f_8	2.0e+01	2.0e+01	+	2.1e+01	+	2.0e+01	·
	(6.7e−02)	(9.0e−02)		(1.3e−01)		(7.4e−02)	
f_9	5.9e−01	1.2e+00	·	7.9e+00	+	2.4e+00	·
	(7.3e−01)	(9.3e−01)		(2.1e+00)		(3.1e+00)	
f_{10}	2.4e−02	1.0e−01	+	3.6e+00	+	3.9e−01	+
	(2.9e−02)	(8.9e−02)		(7.8e+00)		(8.9e−02)	
f_{11}	1.7e+01	2.4e+01	+	3.6e+01	·	2.5e+01	+
	(6.3e+00)	(7.1e+00)		(2.3e+01)		(3.5e+00)	
f_{12}	1.9e+01	2.5e+01	+	4.2e+01	+	2.4e+01	·
	(6.6e+00)	(7.1e+00)		(2.4e+01)		(4.2e+00)	
f_{13}	1.6e+01	2.8e+01	+	5.2e+01	+	2.3e+01	+
	(7.3e+00)	(7.7e+00)		(1.5e+01)		(3.8e+00)	
f_{14}	1.3e+03	1.6e+03	+	2.0e+03	+	1.4e+03	·
	(1.8e+02)	(1.9e+02)		(2.5e+02)		(1.5e+02)	
f_{15}	1.2e+03	1.5e+03	+	2.0e+03	+	1.3e+03	·
	(1.7e+02)	(1.9e+02)		(2.7e+02)		(1.4e+02)	
f_{16}	9.7e−01	1.6e+00	+	2.3e+00	+	1.1e+00	+
	(1.9e−01)	(2.8e−01)		(5.1e−01)		(2.3e−01)	
f_{17}	3.3e+01	4.4e+01	+	6.6e+01	+	3.5e+01	·
	(4.7e+00)	(4.7e+00)		(2.1e+01)		(4.0e+00)	
f_{18}	3.3e+01	4.3e+01	+	7.4e+01	+	3.5e+01	·
	(4.6e+00)	(5.9e+00)		(1.5e+01)		(4.0e+00)	
f_{19}	1.9e+00	2.5e+00	+	3.5e+00	·	2.0e+00	·
	(3.8e−01)	(4.9e−01)		(1.8e+00)		(2.7e−01)	
f_{20}	2.3e+00	3.0e+00	+	4.1e+00	+	2.4e+00	·
	(2.6e−01)	(3.4e−01)		(2.5e−01)		(1.7e−01)	
f_{21}	3.4e+02	3.3e+02	·	3.7e+02	+	4.0e+02	·
	(9.8e+01)	(1.1e+02)		(7.0e+01)		(0.0e+00)	
f_{22}	1.2e+03	1.6e+03	+	2.0e+03	+	1.4e+03	+
	(2.0e+02)	(2.5e+02)		(3.4e+02)		(1.4e+02)	
f_{23}	1.1e+03	1.6e+03	+	2.1e+03	+	1.3e+03	+
	(1.9e+02)	(2.3e+02)		(3.2e+02)		(1.4e+02)	
f_{24}	2.0e+02	2.0e+02	·	2.2e+02	+	2.0e+02	·
	(3.6e+00)	(1.5e+01)		(5.5e+00)		(9.5e−01)	
f_{25}	2.0e+02	2.0e+02	·	2.2e+02	+	2.0e+02	+
	(1.0e+01)	(3.6e+00)		(6.6e+00)		(5.1e−05)	
f_{26}	1.5e+02	1.5e+02	·	1.8e+02	·	1.5e+02	·
	(3.9e+01)	(4.1e+01)		(5.8e+01)		(3.2e+01)	
f_{27}	3.0e+02	3.1e+02	·	4.9e+02	+	3.0e+02	+
	(1.8e+01)	(4.0e+01)		(8.7e+01)		(1.1e−05)	
f_{28}	2.8e+02	2.5e+02	·	3.6e+02	+	3.0e+02	+
	(6.5e+01)	(8.6e+01)		(1.5e+02)		(1.8e−13)	
Summary (+/·/−)		16/12/0		24/4/0		10/18/0	

Table 86: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.3e+01	1.5e+03	+	4.3e−10	−	0.0e+00	−
	(4.0e+01)	(1.1e+03)		(3.1e−09)		(0.0e+00)	
f_2	1.0e+06	4.9e+06	+	7.2e+04	−	1.4e+03	−
	(1.7e+06)	(3.8e+06)		(2.6e+05)		(3.7e+03)	
f_3	2.2e+08	3.3e+09	+	4.9e+06	−	4.7e+03	−
	(4.8e+08)	(3.2e+09)		(1.7e+07)		(2.1e+04)	
f_4	2.6e+03	1.1e+04	+	8.3e+01	−	3.9e+01	−
	(2.6e+03)	(5.0e+03)		(2.4e+02)		(2.8e+02)	
f_5	3.9e+01	4.1e+02	+	1.7e+00	−	2.1e−02	−
	(4.6e+01)	(4.5e+02)		(6.7e+00)		(1.5e−01)	
f_6	2.4e+01	8.9e+01	+	7.0e+00	−	6.2e+00	−
	(2.5e+01)	(6.4e+01)		(9.6e+00)		(4.3e+00)	
f_7	6.3e+00	4.0e+01	+	2.5e+01	+	2.3e+00	−
	(6.5e+00)	(2.4e+01)		(2.5e+01)		(4.7e+00)	
f_8	2.0e+01	2.0e+01	+	2.1e+01	+	2.0e+01	·
	(7.8e−02)	(1.0e−01)		(1.1e−01)		(8.3e−02)	
f_9	2.0e+00	4.2e+00	+	4.1e+00	+	1.7e+00	·
	(9.7e−01)	(1.1e+00)		(1.6e+00)		(9.4e−01)	
f_{10}	4.6e+00	1.3e+02	+	6.2e−01	·	9.7e−02	−
	(1.0e+01)	(1.1e+02)		(3.6e−01)		(4.6e−02)	
f_{11}	8.5e+00	3.0e+01	+	4.7e+01	+	2.5e+01	+
	(3.9e+00)	(1.4e+01)		(1.5e+01)		(9.1e+00)	
f_{12}	8.2e+00	3.0e+01	+	4.5e+01	+	2.0e+01	+
	(3.5e+00)	(1.3e+01)		(1.4e+01)		(9.6e+00)	
f_{13}	1.5e+01	4.4e+01	+	5.0e+01	+	1.7e+01	·
	(1.0e+01)	(2.0e+01)		(1.2e+01)		(8.6e+00)	
f_{14}	7.8e+02	9.9e+02	·	1.9e+03	+	1.3e+03	+
	(3.9e+02)	(3.1e+02)		(2.8e+02)		(1.7e+02)	
f_{15}	5.9e+02	9.8e+02	+	1.9e+03	+	1.3e+03	+
	(3.7e+02)	(2.9e+02)		(2.7e+02)		(2.4e+02)	
f_{16}	6.2e−01	1.5e+00	+	2.3e+00	+	1.2e+00	+
	(1.6e−01)	(3.3e−01)		(3.9e−01)		(2.1e−01)	
f_{17}	2.2e+01	4.3e+01	+	6.5e+01	+	3.5e+01	+
	(3.8e+00)	(1.2e+01)		(1.3e+01)		(6.8e+00)	
f_{18}	2.4e+01	4.8e+01	+	6.3e+01	+	3.7e+01	+
	(4.2e+00)	(1.4e+01)		(9.0e+00)		(6.5e+00)	
f_{19}	8.7e−01	8.2e+01	+	3.6e+00	+	1.6e+00	+
	(3.1e−01)	(2.7e+02)		(1.0e+00)		(4.1e−01)	
f_{20}	2.3e+00	3.3e+00	+	3.9e+00	+	2.6e+00	·
	(7.4e−01)	(3.6e−01)		(2.9e−01)		(6.7e−01)	
f_{21}	3.9e+02	4.3e+02	+	3.8e+02	−	3.8e+02	−
	(3.7e+01)	(5.5e+01)		(6.8e+01)		(6.0e+01)	
f_{22}	4.4e+02	1.0e+03	+	2.0e+03	+	1.2e+03	+
	(3.2e+02)	(2.6e+02)		(3.7e+02)		(3.8e+02)	
f_{23}	4.5e+02	1.1e+03	+	2.1e+03	+	1.2e+03	+
	(3.1e+02)	(3.2e+02)		(3.2e+02)		(4.0e+02)	
f_{24}	2.1e+02	2.1e+02	+	2.1e+02	·	2.1e+02	·
	(4.7e+00)	(2.6e+01)		(9.3e+00)		(1.3e+01)	
f_{25}	2.1e+02	2.1e+02	+	2.1e+02	+	2.1e+02	·
	(4.8e+00)	(1.5e+01)		(1.1e+01)		(1.3e+01)	
f_{26}	1.6e+02	1.9e+02	+	2.3e+02	·	2.2e+02	·
	(5.9e+01)	(5.5e+01)		(6.2e+01)		(5.9e+01)	
f_{27}	3.6e+02	5.2e+02	+	4.5e+02	+	3.9e+02	·
	(7.4e+01)	(6.8e+01)		(9.3e+01)		(1.0e+02)	
f_{28}	4.2e+02	6.9e+02	+	3.2e+02	−	3.0e+02	−
	(1.3e+02)	(1.5e+02)		(1.1e+02)		(7.5e+01)	
Summary (+/·/−)		27/1/0		17/3/8		10/8/10	

Table 87: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	1.3e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(7.2e+00)		(0.0e+00)	
f_2	6.7e−02	6.7e−02	·	2.0e+02	·	1.8e−01	+
	(4.0e−02)	(4.0e−02)		(1.3e+03)		(1.1e−01)	
f_3	2.4e+00	1.6e+00	·	4.4e+05	−	8.9e+03	+
	(3.4e+00)	(1.3e+00)		(3.1e+06)		(1.9e+04)	
f_4	6.1e−04	5.6e−04	·	3.6e−03	−	1.2e−03	+
	(4.7e−04)	(3.5e−04)		(1.5e−02)		(5.5e−04)	
f_5	0.0e+00	0.0e+00	·	2.0e−06	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(1.2e−05)		(0.0e+00)	
f_6	8.9e−08	4.6e−07	·	3.8e+00	·	5.4e−08	·
	(1.2e−07)	(2.5e−06)		(4.7e+00)		(3.3e−08)	
f_7	5.1e−02	4.2e−02	·	1.8e+01	+	2.1e+00	+
	(3.4e−02)	(2.0e−02)		(1.6e+01)		(7.0e−01)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(7.6e−02)	(1.0e−01)		(9.6e−02)		(6.3e−02)	
f_9	9.4e−01	1.2e+00	·	4.4e+00	+	8.3e+00	+
	(9.0e−01)	(1.2e+00)		(1.9e+00)		(6.6e−01)	
f_{10}	1.5e−01	1.3e−01	·	2.6e−01	+	5.4e−01	+
	(9.5e−02)	(9.2e−02)		(1.7e−01)		(9.4e−02)	
f_{11}	1.6e+00	1.4e+00	·	6.3e+00	+	2.7e+01	+
	(1.3e+00)	(1.2e+00)		(4.5e+00)		(3.4e+00)	
f_{12}	1.3e+01	1.2e+01	·	2.2e+01	+	3.3e+01	+
	(6.4e+00)	(6.3e+00)		(8.1e+00)		(4.4e+00)	
f_{13}	1.5e+01	1.5e+01	·	3.8e+01	+	3.2e+01	+
	(7.2e+00)	(7.5e+00)		(1.7e+01)		(4.0e+00)	
f_{14}	3.6e+01	4.2e+01	·	1.9e+02	+	1.3e+03	+
	(2.3e+01)	(3.3e+01)		(1.4e+02)		(1.3e+02)	
f_{15}	1.1e+03	1.1e+03	·	8.7e+02	·	1.4e+03	+
	(2.4e+02)	(3.0e+02)		(3.3e+02)		(1.5e+02)	
f_{16}	1.2e+00	1.2e+00	·	1.4e+00	·	1.1e+00	·
	(2.5e−01)	(3.3e−01)		(6.7e−01)		(1.6e−01)	
f_{17}	1.3e+01	1.3e+01	·	1.8e+01	+	3.7e+01	+
	(1.4e+00)	(1.2e+00)		(6.1e+00)		(3.7e+00)	
f_{18}	3.3e+01	3.3e+01	·	3.2e+01	·	4.2e+01	+
	(5.9e+00)	(6.9e+00)		(1.0e+01)		(5.0e+00)	
f_{19}	7.0e−01	7.2e−01	·	1.1e+00	+	2.5e+00	+
	(1.7e−01)	(2.4e−01)		(5.0e−01)		(3.7e−01)	
f_{20}	2.6e+00	2.5e+00	·	3.5e+00	+	3.0e+00	+
	(3.7e−01)	(4.4e−01)		(4.1e−01)		(2.2e−01)	
f_{21}	3.8e+02	3.4e+02	·	3.6e+02	·	4.0e+02	·
	(6.5e+01)	(9.4e+01)		(7.7e+01)		(0.0e+00)	
f_{22}	9.2e+01	1.1e+02	·	2.5e+02	+	1.4e+03	+
	(5.4e+01)	(6.6e+01)		(1.5e+02)		(1.5e+02)	
f_{23}	1.0e+03	1.0e+03	·	1.0e+03	·	1.5e+03	+
	(3.1e+02)	(3.3e+02)		(3.3e+02)		(1.8e+02)	
f_{24}	2.0e+02	2.0e+02	·	2.1e+02	+	2.1e+02	+
	(2.6e+01)	(2.3e+01)		(2.0e+01)		(5.5e+00)	
f_{25}	2.0e+02	2.0e+02	·	2.1e+02	+	2.1e+02	+
	(1.1e+01)	(1.7e+01)		(1.3e+01)		(4.3e+00)	
f_{26}	1.4e+02	1.4e+02	·	1.8e+02	·	1.7e+02	·
	(4.2e+01)	(4.3e+01)		(4.5e+01)		(2.8e+01)	
f_{27}	3.2e+02	3.0e+02	·	4.1e+02	+	3.0e+02	+
	(5.3e+01)	(2.5e+01)		(9.9e+01)		(8.5e−01)	
f_{28}	2.6e+02	2.6e+02	·	3.2e+02	·	2.9e+02	·
	(8.0e+01)	(7.7e+01)		(9.1e+01)		(3.9e+01)	
Summary (+/·/−)		0/28/0		15/11/2		20/8/0	

Table 88: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	5.2e−04	8.5e−05	−	1.3e+02	+	2.1e−04	−
	(2.9e−04)	(4.6e−05)		(2.2e+02)		(9.3e−05)	
f_2	1.4e+05	4.9e+03	−	1.4e+06	·	1.3e+05	·
	(5.7e+04)	(3.7e+03)		(2.2e+06)		(5.3e+04)	
f_3	2.6e+07	3.6e+04	−	3.0e+08	·	6.2e+07	+
	(1.5e+07)	(3.1e+04)		(4.4e+08)		(2.0e+07)	
f_4	6.3e+02	1.7e+01	−	1.1e+04	·	6.1e+02	·
	(2.0e+02)	(1.4e+01)		(1.3e+04)		(1.9e+02)	
f_5	4.1e−03	8.9e−04	−	9.6e+00	+	2.4e−03	−
	(1.6e−03)	(4.0e−04)		(8.9e+00)		(8.6e−04)	
f_6	1.4e−01	3.0e−02	−	1.5e+01	+	1.8e−01	·
	(5.8e−02)	(1.4e−02)		(1.9e+01)		(7.6e−02)	
f_7	1.7e+01	6.7e−01	−	3.0e+01	+	2.0e+01	+
	(3.2e+00)	(4.1e−01)		(2.0e+01)		(3.5e+00)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(6.3e−02)	(9.5e−02)		(1.2e−01)		(7.2e−02)	
f_9	8.6e+00	1.5e+00	−	6.6e+00	−	8.6e+00	·
	(5.5e−01)	(7.9e−01)		(1.9e+00)		(7.0e−01)	
f_{10}	9.3e−01	6.3e−01	−	2.0e+01	+	8.6e−01	−
	(1.0e−01)	(1.4e−01)		(2.5e+01)		(9.2e−02)	
f_{11}	3.4e+01	2.2e−01	−	1.9e+01	−	3.5e+01	·
	(4.5e+00)	(5.0e−01)		(5.1e+00)		(5.2e+00)	
f_{12}	4.3e+01	9.7e+00	−	4.4e+01	·	4.2e+01	·
	(4.7e+00)	(3.7e+00)		(1.6e+01)		(5.2e+00)	
f_{13}	4.2e+01	1.9e+01	−	4.9e+01	·	4.2e+01	·
	(5.9e+00)	(8.5e+00)		(1.3e+01)		(5.0e+00)	
f_{14}	1.2e+03	5.7e+00	−	4.2e+02	−	1.3e+03	·
	(1.2e+02)	(5.7e+00)		(1.8e+02)		(1.4e+02)	
f_{15}	1.4e+03	4.0e+02	−	1.6e+03	+	1.5e+03	·
	(1.8e+02)	(1.8e+02)		(2.4e+02)		(1.5e+02)	
f_{16}	1.2e+00	1.2e+00	·	1.8e+00	+	1.1e+00	·
	(1.9e−01)	(3.7e−01)		(3.2e−01)		(2.7e−01)	
f_{17}	5.1e+01	1.2e+01	−	4.1e+01	−	5.3e+01	·
	(6.9e+00)	(6.9e−01)		(1.4e+01)		(6.0e+00)	
f_{18}	5.7e+01	2.0e+01	−	6.9e+01	+	5.9e+01	·
	(6.4e+00)	(4.2e+00)		(1.6e+01)		(7.9e+00)	
f_{19}	3.3e+00	5.0e−01	−	3.2e+00	−	3.4e+00	·
	(4.8e−01)	(1.4e−01)		(3.1e+00)		(5.5e−01)	
f_{20}	3.4e+00	2.3e+00	−	3.8e+00	+	3.4e+00	·
	(2.0e−01)	(5.1e−01)		(2.9e−01)		(2.2e−01)	
f_{21}	3.1e+02	2.7e+02	−	3.7e+02	+	3.7e+02	·
	(1.0e+02)	(1.0e+02)		(7.4e+01)		(6.8e+01)	
f_{22}	1.4e+03	5.9e+01	−	5.9e+02	−	1.5e+03	·
	(1.4e+02)	(4.7e+01)		(2.2e+02)		(1.6e+02)	
f_{23}	1.6e+03	4.5e+02	−	1.8e+03	·	1.6e+03	·
	(1.4e+02)	(2.3e+02)		(2.9e+02)		(1.7e+02)	
f_{24}	2.1e+02	2.1e+02	−	2.2e+02	+	2.2e+02	+
	(1.3e+01)	(1.4e+01)		(4.5e+00)		(1.7e+00)	
f_{25}	2.1e+02	2.0e+02	−	2.2e+02	+	2.2e+02	+
	(8.2e+00)	(1.3e+01)		(1.1e+01)		(2.2e+00)	
f_{26}	1.8e+02	1.5e+02	−	2.0e+02	+	1.9e+02	·
	(2.1e+01)	(4.4e+01)		(2.5e+01)		(1.5e+01)	
f_{27}	4.4e+02	3.1e+02	−	4.9e+02	+	5.2e+02	+
	(4.3e+01)	(2.5e+01)		(7.1e+01)		(3.6e+01)	
f_{28}	2.6e+02	2.2e+02	−	4.7e+02	+	3.0e+02	·
	(8.3e+01)	(9.9e+01)		(1.6e+02)		(2.8e+01)	
Summary (+/·/−)		0/2/26		16/6/6		5/20/3	

Table 89: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	1.2e+02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.5e+02)		(0.0e+00)		(0.0e+00)	
f_2	0.0e+00	4.8e+06	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(4.0e+06)		(0.0e+00)		(0.0e+00)	
f_3	1.5e−01	2.6e+09	+	4.2e−02	·	7.0e−03	·
	(9.0e−01)	(2.0e+09)		(2.0e−01)		(2.1e−02)	
f_4	0.0e+00	1.4e+04	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(5.7e+03)		(0.0e+00)		(0.0e+00)	
f_5	0.0e+00	1.1e+02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.4e+02)		(0.0e+00)		(0.0e+00)	
f_6	4.2e+00	4.7e+01	+	5.7e+00	·	4.0e+00	·
	(4.9e+00)	(3.7e+01)		(8.6e+00)		(4.8e+00)	
f_7	7.9e+00	4.7e+01	+	1.0e+01	·	8.8e−02	−
	(1.2e+01)	(2.3e+01)		(1.7e+01)		(3.0e−01)	
f_8	2.1e+01	2.0e+01	−	2.1e+01	·	2.0e+01	−
	(1.3e−01)	(8.3e−02)		(1.2e−01)		(8.7e−02)	
f_9	2.5e+00	4.2e+00	+	2.6e+00	·	1.5e+00	·
	(1.4e+00)	(1.3e+00)		(1.7e+00)		(9.6e−01)	
f_{10}	2.8e−01	3.8e+01	+	2.7e−01	·	5.4e−01	+
	(2.2e−01)	(3.9e+01)		(2.1e−01)		(8.6e−02)	
f_{11}	1.1e+01	9.7e+00	·	1.1e+01	·	2.2e+01	+
	(5.0e+00)	(6.1e+00)		(4.8e+00)		(4.6e+00)	
f_{12}	2.0e+01	1.9e+01	·	2.1e+01	·	2.8e+01	+
	(8.9e+00)	(7.9e+00)		(9.6e+00)		(4.8e+00)	
f_{13}	3.2e+01	3.5e+01	·	3.2e+01	·	2.8e+01	·
	(1.1e+01)	(1.5e+01)		(1.2e+01)		(6.4e+00)	
f_{14}	4.1e+02	7.8e+01	−	4.3e+02	·	1.1e+03	+
	(1.9e+02)	(7.7e+01)		(2.5e+02)		(2.2e+02)	
f_{15}	1.3e+03	5.5e+02	−	1.3e+03	·	1.3e+03	·
	(4.4e+02)	(1.9e+02)		(3.3e+02)		(2.0e+02)	
f_{16}	1.6e+00	1.1e+00	−	1.6e+00	·	1.2e+00	−
	(4.8e−01)	(2.6e−01)		(4.2e−01)		(1.6e−01)	
f_{17}	2.0e+01	1.5e+01	−	2.1e+01	·	3.3e+01	+
	(6.7e+00)	(5.3e+00)		(7.3e+00)		(4.1e+00)	
f_{18}	4.1e+01	2.5e+01	−	4.2e+01	·	3.7e+01	·
	(1.0e+01)	(7.2e+00)		(1.2e+01)		(5.2e+00)	
f_{19}	1.1e+00	1.3e+01	·	1.2e+00	·	2.0e+00	+
	(4.9e−01)	(3.7e+01)		(4.2e−01)		(3.9e−01)	
f_{20}	3.4e+00	3.1e+00	·	3.4e+00	·	2.9e+00	−
	(4.7e−01)	(5.3e−01)		(3.9e−01)		(5.5e−01)	
f_{21}	3.8e+02	4.0e+02	+	3.9e+02	·	3.8e+02	·
	(5.4e+01)	(3.8e+01)		(3.9e+01)		(6.0e+01)	
f_{22}	5.8e+02	2.4e+02	−	5.3e+02	·	1.1e+03	+
	(2.1e+02)	(1.3e+02)		(1.8e+02)		(2.3e+02)	
f_{23}	1.3e+03	7.5e+02	−	1.3e+03	·	1.3e+03	·
	(4.2e+02)	(2.4e+02)		(4.4e+02)		(2.5e+02)	
f_{24}	2.1e+02	2.0e+02	·	2.1e+02	·	2.0e+02	−
	(1.4e+01)	(2.8e+01)		(1.4e+01)		(9.9e+00)	
f_{25}	2.1e+02	2.1e+02	+	2.1e+02	·	2.0e+02	·
	(1.6e+01)	(2.0e+01)		(1.6e+01)		(1.6e+01)	
f_{26}	2.2e+02	1.7e+02	·	2.1e+02	·	2.1e+02	·
	(7.2e+01)	(4.3e+01)		(7.1e+01)		(7.2e+01)	
f_{27}	3.9e+02	4.9e+02	+	4.0e+02	·	3.6e+02	−
	(9.8e+01)	(7.0e+01)		(1.0e+02)		(8.8e+01)	
f_{28}	3.0e+02	5.6e+02	+	2.9e+02	·	3.0e+02	·
	(5.7e+01)	(1.5e+02)		(4.2e+01)		(5.3e+01)	
Summary (+/·/−)		13/7/8		0/28/0		7/15/6	

Table 90: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	2.5e−05	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(1.8e−04)		(0.0e+00)	
f_2	4.7e+01	4.1e−02	−	1.3e+04	−	8.2e+01	+
	(9.0e+01)	(2.8e−02)		(7.2e+04)		(8.2e+01)	
f_3	4.3e+04	1.9e+00	−	1.7e+04	−	1.2e+06	+
	(8.8e+04)	(4.3e+00)		(8.5e+04)		(3.0e+06)	
f_4	2.4e−01	3.2e−04	−	1.1e−03	−	5.0e−01	+
	(2.0e−01)	(1.9e−04)		(2.7e−03)		(4.0e−01)	
f_5	0.0e+00	0.0e+00	·	1.5e−01	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(8.4e−01)		(0.0e+00)	
f_6	1.2e−05	6.3e−08	−	4.4e+00	·	1.6e−05	·
	(1.4e−05)	(1.1e−07)		(4.9e+00)		(1.1e−05)	
f_7	1.9e+00	4.0e−02	−	1.4e+01	+	6.2e+00	+
	(9.5e−01)	(2.2e−02)		(1.1e+01)		(2.6e+00)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(9.5e−02)	(8.6e−02)		(1.1e−01)		(8.1e−02)	
f_9	4.3e+00	8.9e−01	−	4.3e+00	·	7.6e+00	+
	(3.0e+00)	(9.4e−01)		(1.6e+00)		(1.8e+00)	
f_{10}	6.5e−01	1.4e−01	−	3.4e−01	−	7.2e−01	·
	(9.5e−02)	(9.7e−02)		(4.9e−01)		(1.0e−01)	
f_{11}	1.9e+01	1.4e+00	−	5.3e+00	−	3.2e+01	+
	(8.0e+00)	(1.0e+00)		(3.5e+00)		(6.1e+00)	
f_{12}	3.5e+01	1.1e+01	−	2.3e+01	−	3.7e+01	·
	(6.7e+00)	(5.0e+00)		(9.5e+00)		(5.9e+00)	
f_{13}	3.6e+01	1.4e+01	−	3.8e+01	·	3.9e+01	·
	(6.2e+00)	(6.1e+00)		(1.3e+01)		(4.5e+00)	
f_{14}	6.0e+02	3.7e+01	−	2.2e+02	−	1.2e+03	+
	(2.8e+02)	(2.0e+01)		(1.3e+02)		(1.5e+02)	
f_{15}	1.4e+03	1.1e+03	·	9.3e+02	−	1.4e+03	·
	(2.3e+02)	(3.0e+02)		(3.2e+02)		(1.5e+02)	
f_{16}	1.1e+00	1.2e+00	·	1.6e+00	+	1.2e+00	·
	(1.8e−01)	(2.7e−01)		(4.6e−01)		(2.0e−01)	
f_{17}	3.2e+01	1.3e+01	−	1.8e+01	−	4.6e+01	+
	(6.6e+00)	(1.1e+00)		(7.1e+00)		(5.5e+00)	
f_{18}	4.9e+01	3.3e+01	−	3.2e+01	−	4.8e+01	·
	(6.5e+00)	(6.4e+00)		(1.2e+01)		(6.8e+00)	
f_{19}	2.5e+00	7.2e−01	−	1.1e+00	−	2.9e+00	·
	(5.5e−01)	(2.1e−01)		(5.4e−01)		(4.7e−01)	
f_{20}	3.0e+00	2.5e+00	−	3.4e+00	+	3.1e+00	·
	(2.5e−01)	(4.3e−01)		(4.0e−01)		(3.0e−01)	
f_{21}	3.7e+02	3.5e+02	·	3.7e+02	·	3.8e+02	·
	(7.2e+01)	(9.0e+01)		(7.6e+01)		(6.7e+01)	
f_{22}	7.2e+02	1.1e+02	−	2.7e+02	−	1.3e+03	+
	(3.3e+02)	(6.7e+01)		(1.6e+02)		(1.8e+02)	
f_{23}	1.5e+03	1.1e+03	−	1.0e+03	−	1.5e+03	·
	(1.9e+02)	(3.0e+02)		(3.0e+02)		(2.2e+02)	
f_{24}	2.1e+02	2.0e+02	·	2.1e+02	+	2.1e+02	+
	(3.2e+00)	(1.4e+01)		(4.6e+00)		(4.9e+00)	
f_{25}	2.0e+02	2.0e+02	−	2.1e+02	+	2.1e+02	+
	(3.0e+00)	(2.2e+00)		(4.9e+00)		(5.2e+00)	
f_{26}	1.7e+02	1.5e+02	−	1.7e+02	−	1.7e+02	+
	(3.4e+01)	(4.4e+01)		(3.8e+01)		(3.1e+01)	
f_{27}	3.5e+02	3.0e+02	−	4.0e+02	·	3.6e+02	+
	(8.2e+01)	(2.4e+01)		(1.1e+02)		(8.2e+01)	
f_{28}	2.8e+02	2.6e+02	−	2.9e+02	−	2.8e+02	·
	(5.4e+01)	(7.7e+01)		(1.0e+02)		(5.4e+01)	
Summary (+/·/−)		0/7/21		6/7/15		13/15/0	

Table 91: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	0.0e+00	0.0e+00	·	6.3e−07	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(2.6e−06)		(0.0e+00)	
f_3	3.8e−01	1.8e−01	·	1.2e+00	−	1.5e−01	·
	(9.4e−01)	(2.1e−01)		(7.6e+00)		(9.7e−02)	
f_4	0.0e+00	0.0e+00	·	8.0e−09	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(1.6e−08)		(0.0e+00)	
f_5	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_6	1.9e−01	5.8e−01	·	3.5e+00	·	1.9e−01	·
	(1.4e+00)	(2.3e+00)		(4.7e+00)		(1.4e+00)	
f_7	6.3e−03	3.2e−04	−	9.5e+00	+	2.5e−02	+
	(3.9e−03)	(2.7e−04)		(1.3e+01)		(1.2e−02)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(6.0e−02)	(8.0e−02)		(1.0e−01)		(7.1e−02)	
f_9	4.1e+00	6.3e−01	−	3.2e+00	·	7.2e+00	+
	(2.6e+00)	(7.6e−01)		(2.1e+00)		(1.7e+00)	
f_{10}	4.5e−01	6.9e−02	−	3.1e−01	−	4.9e−01	·
	(9.3e−02)	(6.0e−02)		(2.3e−01)		(7.8e−02)	
f_{11}	2.1e+01	4.7e−01	−	1.1e+01	−	2.2e+01	·
	(3.5e+00)	(6.0e−01)		(6.1e+00)		(3.8e+00)	
f_{12}	2.6e+01	9.2e+00	−	1.9e+01	−	2.6e+01	·
	(4.1e+00)	(5.5e+00)		(8.8e+00)		(4.9e+00)	
f_{13}	2.7e+01	1.3e+01	−	3.0e+01	·	2.6e+01	·
	(3.6e+00)	(7.0e+00)		(1.1e+01)		(4.3e+00)	
f_{14}	1.2e+03	2.8e+01	−	4.2e+02	−	1.2e+03	·
	(1.2e+02)	(2.2e+01)		(1.9e+02)		(1.4e+02)	
f_{15}	1.4e+03	1.0e+03	−	1.4e+03	·	1.4e+03	·
	(1.6e+02)	(2.7e+02)		(3.2e+02)		(1.5e+02)	
f_{16}	1.1e+00	1.2e+00	·	1.7e+00	+	1.1e+00	·
	(2.3e−01)	(2.5e−01)		(4.4e−01)		(1.7e−01)	
f_{17}	3.2e+01	1.2e+01	−	2.4e+01	−	3.2e+01	·
	(3.3e+00)	(8.9e−01)		(6.1e+00)		(2.9e+00)	
f_{18}	3.7e+01	3.2e+01	·	5.0e+01	+	3.7e+01	·
	(4.3e+00)	(7.6e+00)		(1.1e+01)		(3.8e+00)	
f_{19}	2.1e+00	6.3e−01	−	1.2e+00	−	2.1e+00	·
	(3.2e−01)	(2.0e−01)		(5.8e−01)		(3.7e−01)	
f_{20}	2.7e+00	2.3e+00	−	3.5e+00	+	2.7e+00	·
	(2.2e−01)	(3.6e−01)		(4.2e−01)		(1.7e−01)	
f_{21}	4.0e+02	3.6e+02	·	3.7e+02	·	4.0e+02	·
	(6.8e+00)	(8.8e+01)		(7.0e+01)		(0.0e+00)	
f_{22}	1.3e+03	8.1e+01	−	4.8e+02	−	1.3e+03	·
	(1.5e+02)	(6.6e+01)		(2.1e+02)		(1.5e+02)	
f_{23}	1.4e+03	8.9e+02	−	1.5e+03	·	1.4e+03	·
	(1.7e+02)	(3.0e+02)		(4.2e+02)		(1.5e+02)	
f_{24}	2.0e+02	2.0e+02	·	2.1e+02	+	2.0e+02	·
	(9.7e+00)	(2.6e+01)		(1.4e+01)		(2.2e+00)	
f_{25}	2.0e+02	2.0e+02	·	2.1e+02	+	2.0e+02	+
	(6.4e−01)	(1.3e+01)		(5.2e+00)		(8.9e−02)	
f_{26}	1.3e+02	1.4e+02	·	1.8e+02	+	1.5e+02	+
	(1.4e+01)	(4.5e+01)		(5.6e+01)		(3.1e+01)	
f_{27}	3.0e+02	3.0e+02	−	3.9e+02	+	3.0e+02	+
	(2.2e−03)	(2.5e+01)		(1.0e+02)		(4.6e−03)	
f_{28}	3.0e+02	2.6e+02	·	3.0e+02	·	3.0e+02	+
	(0.0e+00)	(8.0e+01)		(2.8e+01)		(2.9e−13)	
Summary (+/·/−)		0/14/14		9/11/8		6/22/0	

Table 92: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	7.7e−01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(4.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	0.0e+00	1.5e+06	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.8e+06)		(0.0e+00)		(0.0e+00)	
f_3	4.0e−01	3.2e+08	+	1.3e−01	·	1.2e−01	·
	(1.5e+00)	(3.5e+08)		(8.8e−01)		(8.1e−01)	
f_4	0.0e+00	6.0e+03	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(3.0e+03)		(0.0e+00)		(0.0e+00)	
f_5	0.0e+00	2.9e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(7.6e+01)		(0.0e+00)		(0.0e+00)	
f_6	5.6e+00	1.6e+01	+	3.9e+00	·	2.4e+00	·
	(4.8e+00)	(1.9e+01)		(4.8e+00)		(4.2e+00)	
f_7	2.4e−01	1.4e+01	+	8.7e+00	+	1.5e−01	·
	(1.1e+00)	(1.1e+01)		(1.8e+01)		(9.1e−01)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(7.3e−02)	(8.6e−02)		(9.1e−02)		(6.5e−02)	
f_9	1.7e+00	2.3e+00	·	2.5e+00	·	1.3e+00	·
	(1.2e+00)	(9.4e−01)		(1.6e+00)		(9.6e−01)	
f_{10}	1.0e−01	6.0e+00	+	3.2e−01	+	5.5e−01	+
	(6.0e−02)	(7.2e+00)		(2.2e−01)		(8.0e−02)	
f_{11}	9.8e+00	1.3e+00	−	1.0e+01	·	2.3e+01	+
	(5.9e+00)	(1.3e+00)		(6.1e+00)		(4.4e+00)	
f_{12}	1.6e+01	8.4e+00	−	2.2e+01	·	3.0e+01	+
	(8.8e+00)	(3.1e+00)		(1.1e+01)		(6.5e+00)	
f_{13}	1.6e+01	1.1e+01	·	3.1e+01	+	3.1e+01	+
	(7.3e+00)	(5.9e+00)		(1.0e+01)		(4.5e+00)	
f_{14}	9.8e+02	1.1e+01	−	4.4e+02	−	1.2e+03	+
	(2.2e+02)	(1.1e+01)		(2.1e+02)		(2.0e+02)	
f_{15}	1.3e+03	4.9e+02	−	1.3e+03	·	1.4e+03	·
	(2.0e+02)	(2.9e+02)		(3.3e+02)		(1.8e+02)	
f_{16}	1.1e+00	1.3e+00	·	1.7e+00	+	1.1e+00	·
	(2.2e−01)	(2.8e−01)		(3.4e−01)		(2.0e−01)	
f_{17}	3.1e+01	1.2e+01	−	1.9e+01	−	3.3e+01	·
	(4.7e+00)	(1.7e+00)		(7.8e+00)		(4.4e+00)	
f_{18}	3.5e+01	2.5e+01	−	4.3e+01	+	4.0e+01	+
	(3.8e+00)	(5.7e+00)		(1.1e+01)		(6.4e+00)	
f_{19}	1.7e+00	6.4e−01	−	1.2e+00	−	2.1e+00	·
	(3.6e−01)	(4.9e−01)		(3.8e−01)		(4.1e−01)	
f_{20}	2.4e+00	2.6e+00	·	3.3e+00	+	2.7e+00	+
	(5.3e−01)	(5.9e−01)		(5.4e−01)		(4.5e−01)	
f_{21}	3.8e+02	3.6e+02	+	3.6e+02	·	3.5e+02	·
	(6.2e+01)	(8.1e+01)		(8.8e+01)		(9.5e+01)	
f_{22}	7.9e+02	5.3e+01	−	4.8e+02	−	1.1e+03	+
	(3.3e+02)	(5.7e+01)		(2.4e+02)		(1.9e+02)	
f_{23}	1.1e+03	4.0e+02	−	1.5e+03	+	1.5e+03	+
	(3.1e+02)	(2.3e+02)		(4.5e+02)		(2.2e+02)	
f_{24}	2.1e+02	2.1e+02	+	2.1e+02	·	2.1e+02	·
	(5.1e+00)	(1.5e+01)		(5.8e+00)		(4.6e+00)	
f_{25}	2.0e+02	2.0e+02	·	2.1e+02	+	2.1e+02	·
	(1.4e+01)	(1.3e+01)		(1.4e+01)		(1.2e+01)	
f_{26}	1.6e+02	1.4e+02	·	1.8e+02	·	1.8e+02	+
	(6.0e+01)	(4.2e+01)		(7.0e+01)		(6.2e+01)	
f_{27}	3.5e+02	3.8e+02	+	4.0e+02	+	3.4e+02	·
	(8.5e+01)	(7.4e+01)		(1.0e+02)		(7.3e+01)	
f_{28}	3.0e+02	3.3e+02	+	3.0e+02	·	3.0e+02	+
	(2.8e+01)	(9.3e+01)		(5.6e+01)		(5.5e+01)	
Summary (+/·/−)		12/7/9		10/14/4		11/17/0	

Table 93: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	1.2e−01	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(6.2e−01)		(0.0e+00)	
f_2	6.6e−01	3.9e−02	−	3.4e+03	−	7.8e−02	−
	(4.5e−01)	(3.2e−02)		(2.4e+04)		(4.0e−02)	
f_3	2.4e+01	1.8e+00	−	1.6e+05	−	2.4e+03	+
	(6.1e+01)	(2.6e+00)		(1.1e+06)		(4.1e+03)	
f_4	4.6e−03	2.7e−04	−	1.0e−03	−	5.9e−04	−
	(1.9e−03)	(2.1e−04)		(2.7e−03)		(2.8e−04)	
f_5	0.0e+00	0.0e+00	·	3.6e−01	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(1.4e+00)		(0.0e+00)	
f_6	2.8e−07	5.0e−08	−	4.2e+00	·	3.1e−08	−
	(1.8e−07)	(5.9e−08)		(4.9e+00)		(3.5e−08)	
f_7	1.3e−01	3.7e−02	−	1.9e+01	+	1.7e+00	+
	(5.0e−02)	(1.9e−02)		(1.5e+01)		(6.6e−01)	
f_8	2.0e+01	2.0e+01	+	2.1e+01	+	2.0e+01	·
	(7.8e−02)	(9.0e−02)		(1.1e−01)		(6.8e−02)	
f_9	2.7e+00	8.9e−01	−	4.1e+00	+	8.4e+00	+
	(2.2e+00)	(8.0e−01)		(1.7e+00)		(5.4e−01)	
f_{10}	4.9e−01	1.6e−01	−	1.3e+00	−	5.4e−01	·
	(7.2e−02)	(1.1e−01)		(6.2e+00)		(7.5e−02)	
f_{11}	2.1e+01	1.2e+00	−	6.1e+00	−	2.6e+01	+
	(4.2e+00)	(1.1e+00)		(4.1e+00)		(4.4e+00)	
f_{12}	3.1e+01	1.2e+01	−	2.1e+01	−	3.2e+01	·
	(4.5e+00)	(5.7e+00)		(1.1e+01)		(4.8e+00)	
f_{13}	3.1e+01	1.3e+01	−	3.8e+01	+	3.2e+01	·
	(4.3e+00)	(6.7e+00)		(1.2e+01)		(3.8e+00)	
f_{14}	1.1e+03	3.9e+01	−	1.9e+02	−	1.2e+03	·
	(1.2e+02)	(2.8e+01)		(1.1e+02)		(1.3e+02)	
f_{15}	1.3e+03	1.1e+03	−	9.5e+02	−	1.4e+03	·
	(1.5e+02)	(2.8e+02)		(2.9e+02)		(1.4e+02)	
f_{16}	1.1e+00	1.3e+00	+	1.6e+00	+	1.1e+00	·
	(2.0e−01)	(2.7e−01)		(5.1e−01)		(2.1e−01)	
f_{17}	3.6e+01	1.3e+01	−	2.1e+01	−	3.7e+01	·
	(4.7e+00)	(9.9e−01)		(8.9e+00)		(4.4e+00)	
f_{18}	4.2e+01	3.5e+01	−	3.6e+01	·	4.3e+01	·
	(4.4e+00)	(7.0e+00)		(1.5e+01)		(4.0e+00)	
f_{19}	2.4e+00	7.1e−01	−	1.0e+00	−	2.5e+00	·
	(3.7e−01)	(2.1e−01)		(5.3e−01)		(3.8e−01)	
f_{20}	3.0e+00	2.5e+00	−	3.4e+00	+	3.0e+00	·
	(1.7e−01)	(3.6e−01)		(4.7e−01)		(2.1e−01)	
f_{21}	3.3e+02	3.2e+02	·	3.7e+02	·	4.0e+02	·
	(9.7e+01)	(9.9e+01)		(7.0e+01)		(0.0e+00)	
f_{22}	1.3e+03	1.1e+02	−	3.3e+02	−	1.4e+03	+
	(1.6e+02)	(6.9e+01)		(1.8e+02)		(1.4e+02)	
f_{23}	1.4e+03	1.0e+03	−	1.0e+03	−	1.5e+03	·
	(1.2e+02)	(3.4e+02)		(3.6e+02)		(1.4e+02)	
f_{24}	2.0e+02	2.0e+02	·	2.1e+02	+	2.1e+02	+
	(9.8e+00)	(1.9e+01)		(5.2e+00)		(5.0e+00)	
f_{25}	2.0e+02	2.0e+02	−	2.1e+02	+	2.1e+02	·
	(2.0e+00)	(1.0e+01)		(1.0e+01)		(4.2e+00)	
f_{26}	1.6e+02	1.4e+02	−	1.7e+02	·	1.8e+02	·
	(3.2e+01)	(4.1e+01)		(5.2e+01)		(2.7e+01)	
f_{27}	3.1e+02	3.2e+02	−	3.9e+02	+	3.0e+02	+
	(4.2e+01)	(5.9e+01)		(1.0e+02)		(1.1e+00)	
f_{28}	2.8e+02	2.6e+02	−	3.0e+02	·	3.0e+02	−
	(6.0e+01)	(8.3e+01)		(8.8e+01)		(4.7e−08)	
Summary (+/·/−)		2/4/22		9/7/12		7/17/4	

Table 94: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00 (0.0e+00)	0.0e+00 (0.0e+00)	·	0.0e+00 (0.0e+00)	·	0.0e+00 (0.0e+00)	·
f_2	0.0e+00 (0.0e+00)	2.9e+03 (5.8e+03)	+	0.0e+00 (0.0e+00)	·	1.9e−07 (3.6e−07)	+
f_3	1.3e−01 (8.8e−01)	2.7e+03 (1.6e+04)	+	1.7e−01 (9.1e−01)	·	4.4e+02 (2.0e+03)	+
f_4	0.0e+00 (0.0e+00)	1.4e+02 (3.8e+02)	+	0.0e+00 (0.0e+00)	·	0.0e+00 (0.0e+00)	·
f_5	0.0e+00 (0.0e+00)	6.0e−09 (4.3e−08)	·	0.0e+00 (0.0e+00)	·	0.0e+00 (0.0e+00)	·
f_6	3.5e+00 (4.7e+00)	5.5e+00 (4.2e+00)	+	3.8e+00 (4.6e+00)	·	2.8e−01 (1.5e+00)	·
f_7	4.8e−05 (1.2e−04)	3.2e−04 (1.3e−03)	·	8.0e+00 (1.2e+01)	+	4.3e−01 (5.7e−01)	+
f_8	2.0e+01 (8.1e−02)	2.0e+01 (7.4e−02)	·	2.1e+01 (1.0e−01)	+	2.0e+01 (7.9e−02)	·
f_9	8.8e−01 (8.4e−01)	6.3e−01 (6.9e−01)	·	2.5e+00 (1.3e+00)	+	2.1e+00 (2.0e+00)	+
f_{10}	1.8e−01 (1.8e−01)	3.5e−02 (2.4e−02)	−	3.0e−01 (2.1e−01)	+	6.8e−01 (1.2e−01)	+
f_{11}	1.7e+01 (4.6e+00)	7.5e−01 (8.1e−01)	−	1.0e+01 (5.0e+00)	−	2.9e+01 (4.4e+00)	+
f_{12}	2.3e+01 (5.2e+00)	6.0e+00 (2.8e+00)	−	2.4e+01 (1.0e+01)	·	3.6e+01 (4.6e+00)	+
f_{13}	2.0e+01 (6.7e+00)	7.4e+00 (4.8e+00)	−	3.4e+01 (1.1e+01)	+	3.4e+01 (6.2e+00)	+
f_{14}	1.0e+03 (1.5e+02)	2.3e+01 (1.6e+01)	−	4.4e+02 (2.2e+02)	−	1.2e+03 (1.9e+02)	+
f_{15}	1.3e+03 (2.2e+02)	9.3e+02 (3.3e+02)	−	1.5e+03 (3.1e+02)	·	1.4e+03 (1.9e+02)	+
f_{16}	1.1e+00 (2.0e−01)	1.3e+00 (2.8e−01)	+	1.7e+00 (3.7e−01)	+	1.2e+00 (1.8e−01)	·
f_{17}	3.0e+01 (3.5e+00)	1.2e+01 (7.5e−01)	−	2.4e+01 (7.1e+00)	−	4.1e+01 (5.1e+00)	+
f_{18}	3.4e+01 (3.6e+00)	3.1e+01 (5.3e+00)	−	4.6e+01 (8.8e+00)	+	4.4e+01 (7.3e+00)	+
f_{19}	1.9e+00 (2.9e−01)	5.6e−01 (1.7e−01)	−	1.3e+00 (5.0e−01)	−	2.6e+00 (5.3e−01)	+
f_{20}	2.3e+00 (3.1e−01)	2.2e+00 (4.9e−01)	·	3.3e+00 (4.1e−01)	+	3.0e+00 (3.5e−01)	+
f_{21}	3.9e+02 (3.9e+01)	3.6e+02 (8.7e+01)	·	3.8e+02 (6.1e+01)	·	3.8e+02 (6.7e+01)	·
f_{22}	9.4e+02 (2.2e+02)	7.5e+01 (5.1e+01)	−	4.6e+02 (2.5e+02)	−	1.2e+03 (2.0e+02)	+
f_{23}	1.2e+03 (1.8e+02)	6.7e+02 (3.4e+02)	−	1.4e+03 (3.7e+02)	·	1.5e+03 (2.3e+02)	+
f_{24}	2.0e+02 (1.2e+01)	1.9e+02 (2.7e+01)	·	2.1e+02 (1.4e+01)	+	2.0e+02 (1.1e+01)	+
f_{25}	2.0e+02 (3.3e+00)	2.0e+02 (1.4e+01)	·	2.1e+02 (4.9e+00)	+	2.1e+02 (4.5e+00)	+
f_{26}	1.6e+02 (4.5e+01)	1.4e+02 (4.2e+01)	·	2.0e+02 (6.0e+01)	+	2.0e+02 (5.4e+01)	+
f_{27}	3.2e+02 (6.3e+01)	3.1e+02 (4.4e+01)	·	3.9e+02 (1.0e+02)	+	3.8e+02 (9.7e+01)	+
f_{28}	2.9e+02 (5.9e+01)	2.7e+02 (7.0e+01)	·	2.9e+02 (3.9e+01)	·	2.9e+02 (3.9e+01)	+
Summary (+/·/−)		5/12/11		12/11/5		21/7/0	

Table 95: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	8.0e−08	8.0e−08	·	2.7e+01	+	1.2e−07	·
	(5.5e−08)	(6.6e−08)		(4.9e+01)		(7.7e−08)	
f_2	1.4e+03	1.3e+03	·	5.2e+05	·	1.2e+04	+
	(9.5e+02)	(6.8e+02)		(1.1e+06)		(4.5e+03)	
f_3	1.2e+04	9.6e+03	·	8.4e+07	+	1.7e+07	+
	(1.8e+04)	(9.2e+03)		(2.8e+08)		(1.1e+07)	
f_4	7.6e+00	8.6e+00	·	4.2e+03	·	5.5e+01	+
	(4.4e+00)	(5.7e+00)		(7.6e+03)		(1.9e+01)	
f_5	7.4e−06	6.8e−06	·	3.1e+00	+	1.3e−05	+
	(3.3e−06)	(3.7e−06)		(6.0e+00)		(4.9e−06)	
f_6	3.2e−03	2.6e−03	·	1.1e+01	+	9.1e−03	+
	(1.8e−03)	(1.3e−03)		(2.1e+01)		(4.3e−03)	
f_7	6.3e−01	6.2e−01	·	2.3e+01	+	1.5e+01	+
	(2.8e−01)	(3.1e−01)		(1.5e+01)		(3.2e+00)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(7.5e−02)	(9.6e−02)		(1.0e−01)		(6.2e−02)	
f_9	1.4e+00	1.5e+00	·	6.1e+00	+	8.7e+00	+
	(8.6e−01)	(9.0e−01)		(1.7e+00)		(5.7e−01)	
f_{10}	3.6e−01	3.8e−01	·	9.0e+00	+	6.7e−01	+
	(1.5e−01)	(1.2e−01)		(2.1e+01)		(7.2e−02)	
f_{11}	3.2e−01	6.3e−01	·	1.8e+01	+	3.1e+01	+
	(4.9e−01)	(7.5e−01)		(7.2e+00)		(5.7e+00)	
f_{12}	7.2e+00	6.6e+00	·	4.0e+01	+	4.0e+01	+
	(3.6e+00)	(3.6e+00)		(1.4e+01)		(4.5e+00)	
f_{13}	1.3e+01	1.5e+01	·	4.8e+01	+	3.9e+01	+
	(6.4e+00)	(8.3e+00)		(1.7e+01)		(5.4e+00)	
f_{14}	4.3e+01	4.0e+01	·	4.5e+02	+	1.3e+03	+
	(3.0e+01)	(2.2e+01)		(2.0e+02)		(1.1e+02)	
f_{15}	1.1e+03	9.5e+02	·	1.5e+03	+	1.4e+03	+
	(3.1e+02)	(3.7e+02)		(3.0e+02)		(1.8e+02)	
f_{16}	1.1e+00	1.2e+00	·	1.6e+00	+	1.2e+00	·
	(2.9e−01)	(2.7e−01)		(4.1e−01)		(2.3e−01)	
f_{17}	1.5e+01	1.4e+01	−	3.5e+01	+	4.7e+01	+
	(1.3e+00)	(2.5e+00)		(1.2e+01)		(5.7e+00)	
f_{18}	3.3e+01	3.3e+01	·	6.6e+01	+	5.3e+01	+
	(1.1e+01)	(9.9e+00)		(1.3e+01)		(6.4e+00)	
f_{19}	7.1e−01	7.1e−01	·	2.0e+00	+	3.1e+00	+
	(2.5e−01)	(2.2e−01)		(1.0e+00)		(5.1e−01)	
f_{20}	2.5e+00	2.7e+00	·	3.7e+00	+	3.3e+00	+
	(5.7e−01)	(4.5e−01)		(2.8e−01)		(2.0e−01)	
f_{21}	3.0e+02	3.1e+02	·	3.7e+02	+	4.0e+02	+
	(1.0e+02)	(1.0e+02)		(8.0e+01)		(1.5e+00)	
f_{22}	1.0e+02	1.0e+02	·	5.1e+02	+	1.5e+03	+
	(5.5e+01)	(5.4e+01)		(2.2e+02)		(1.9e+02)	
f_{23}	8.3e+02	9.1e+02	·	1.7e+03	+	1.6e+03	+
	(4.2e+02)	(4.2e+02)		(3.8e+02)		(1.4e+02)	
f_{24}	2.0e+02	2.1e+02	·	2.1e+02	+	2.2e+02	+
	(3.1e+01)	(2.3e+00)		(4.7e+00)		(1.7e+00)	
f_{25}	2.0e+02	2.0e+02	·	2.1e+02	+	2.2e+02	+
	(1.9e+01)	(1.4e+01)		(1.1e+01)		(1.9e+00)	
f_{26}	1.5e+02	1.5e+02	·	1.8e+02	+	1.8e+02	+
	(4.4e+01)	(4.4e+01)		(3.0e+01)		(1.8e+01)	
f_{27}	3.1e+02	3.0e+02	·	4.8e+02	+	4.3e+02	+
	(1.8e+00)	(1.3e+00)		(8.7e+01)		(6.1e+01)	
f_{28}	2.3e+02	2.6e+02	·	3.4e+02	+	3.0e+02	+
	(9.5e+01)	(8.0e+01)		(1.4e+02)		(5.2e−03)	
Summary (+/·/−)		0/27/1		26/2/0		25/3/0	

Table 96: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.6e+01	1.6e+00	−	3.4e+02	+	1.3e+01	−
	(4.4e+00)	(1.0e+00)		(2.8e+02)		(3.8e+00)	
f_2	3.0e+06	2.5e+05	−	6.1e+06	·	2.7e+06	·
	(1.1e+06)	(2.9e+05)		(4.3e+06)		(9.4e+05)	
f_3	3.1e+08	2.1e+07	−	1.1e+09	+	4.2e+08	·
	(1.1e+08)	(1.6e+07)		(1.4e+09)		(1.5e+08)	
f_4	8.2e+03	1.2e+03	−	1.9e+04	+	8.3e+03	·
	(2.2e+03)	(1.0e+03)		(8.8e+03)		(1.9e+03)	
f_5	3.9e+00	8.1e−01	−	5.4e+01	+	3.2e+00	·
	(1.1e+00)	(3.2e−01)		(5.1e+01)		(9.2e−01)	
f_6	9.0e+00	2.1e+00	−	5.1e+01	+	1.5e+01	+
	(2.5e+00)	(6.4e−01)		(3.6e+01)		(4.4e+00)	
f_7	3.5e+01	8.4e+00	−	5.4e+01	+	3.8e+01	·
	(6.0e+00)	(3.5e+00)		(2.5e+01)		(6.4e+00)	
f_8	2.0e+01	2.0e+01	+	2.1e+01	+	2.0e+01	·
	(8.8e−02)	(1.9e+00)		(9.7e−02)		(6.8e−02)	
f_9	8.5e+00	3.7e+00	−	7.9e+00	·	8.9e+00	·
	(6.3e−01)	(1.2e+00)		(1.7e+00)		(5.5e−01)	
f_{10}	1.6e+01	3.3e+00	−	7.8e+01	+	1.5e+01	·
	(4.0e+00)	(1.3e+00)		(6.2e+01)		(3.9e+00)	
f_{11}	4.1e+01	4.8e+00	−	2.5e+01	−	4.3e+01	·
	(4.7e+00)	(1.8e+00)		(1.0e+01)		(5.4e+00)	
f_{12}	5.2e+01	2.1e+01	−	5.7e+01	·	5.1e+01	·
	(6.9e+00)	(8.9e+00)		(1.6e+01)		(6.8e+00)	
f_{13}	5.2e+01	2.5e+01	−	5.9e+01	+	5.1e+01	·
	(6.2e+00)	(8.5e+00)		(1.3e+01)		(6.7e+00)	
f_{14}	1.3e+03	6.5e+01	−	4.5e+02	−	1.3e+03	·
	(1.6e+02)	(3.6e+01)		(1.9e+02)		(1.5e+02)	
f_{15}	1.5e+03	1.3e+03	−	1.6e+03	·	1.5e+03	·
	(1.4e+02)	(2.6e+02)		(2.3e+02)		(1.2e+02)	
f_{16}	1.2e+00	1.3e+00	·	1.7e+00	+	1.1e+00	·
	(2.2e−01)	(2.6e−01)		(3.6e−01)		(2.2e−01)	
f_{17}	7.4e+01	1.9e+01	−	6.1e+01	−	7.4e+01	·
	(8.3e+00)	(3.2e+00)		(1.9e+01)		(7.9e+00)	
f_{18}	7.9e+01	5.0e+01	−	8.9e+01	·	7.8e+01	·
	(6.4e+00)	(1.1e+01)		(2.0e+01)		(1.1e+01)	
f_{19}	5.0e+00	1.5e+00	−	8.1e+00	·	5.0e+00	·
	(7.3e−01)	(5.2e−01)		(1.0e+01)		(7.3e−01)	
f_{20}	3.7e+00	3.2e+00	−	3.9e+00	+	3.6e+00	·
	(1.6e−01)	(3.6e−01)		(3.1e−01)		(1.8e−01)	
f_{21}	3.4e+02	3.0e+02	·	4.3e+02	+	4.0e+02	+
	(3.2e+01)	(8.8e+01)		(4.7e+01)		(1.7e+01)	
f_{22}	1.5e+03	1.7e+02	−	6.2e+02	−	1.5e+03	·
	(1.4e+02)	(1.0e+02)		(2.3e+02)		(1.2e+02)	
f_{23}	1.7e+03	1.3e+03	−	1.8e+03	·	1.7e+03	·
	(1.7e+02)	(3.5e+02)		(3.0e+02)		(1.7e+02)	
f_{24}	2.2e+02	2.1e+02	−	2.2e+02	·	2.2e+02	+
	(8.0e+00)	(1.4e+01)		(6.9e+00)		(1.9e+00)	
f_{25}	2.2e+02	2.1e+02	−	2.2e+02	·	2.2e+02	+
	(5.1e+00)	(6.4e+00)		(8.0e+00)		(3.3e+00)	
f_{26}	1.9e+02	1.5e+02	−	1.9e+02	·	1.9e+02	·
	(1.1e+01)	(3.5e+01)		(2.1e+01)		(9.9e+00)	
f_{27}	5.6e+02	3.7e+02	−	5.6e+02	·	5.7e+02	·
	(2.6e+01)	(2.6e+01)		(4.6e+01)		(2.6e+01)	
f_{28}	3.2e+02	2.3e+02	−	6.2e+02	+	4.1e+02	·
	(1.5e+02)	(1.1e+02)		(2.0e+02)		(1.1e+02)	
Summary (+/·/−)		1/2/25		13/11/4		4/23/1	

Table 97: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	7.7e−06	6.6e−08	·	2.7e−05	·	4.4e−03	+
	(3.1e−05)	(5.7e−08)		(1.8e−04)		(3.7e−03)	
f_3	5.0e+02	1.7e−01	+	3.6e+06	·	3.0e+03	+
	(3.5e+03)	(1.4e−01)		(2.6e+07)		(8.4e+03)	
f_4	1.3e−07	0.0e+00	·	7.4e−07	·	4.4e−05	+
	(3.7e−07)	(0.0e+00)		(3.5e−06)		(3.8e−05)	
f_5	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_6	3.8e+00	1.9e−01	·	3.0e+00	·	2.8e−01	·
	(4.8e+00)	(1.4e+00)		(4.5e+00)		(1.5e+00)	
f_7	1.0e+01	1.1e−03	−	9.3e+00	·	1.5e+00	−
	(1.3e+01)	(9.6e−04)		(1.3e+01)		(1.3e+00)	
f_8	2.1e+01	2.0e+01	−	2.1e+01	·	2.0e+01	−
	(9.2e−02)	(8.9e−02)		(8.5e−02)		(6.9e−02)	
f_9	3.3e+00	5.4e−01	−	4.1e+00	·	4.6e+00	·
	(1.8e+00)	(6.5e−01)		(1.9e+00)		(3.1e+00)	
f_{10}	2.1e−01	8.2e−02	−	2.4e−01	·	6.3e−01	+
	(1.5e−01)	(6.5e−02)		(1.6e−01)		(8.2e−02)	
f_{11}	1.1e+01	5.1e−01	−	1.1e+01	·	2.9e+01	+
	(6.0e+00)	(6.1e−01)		(6.8e+00)		(4.4e+00)	
f_{12}	2.1e+01	1.1e+01	−	2.5e+01	·	3.4e+01	+
	(1.3e+01)	(4.7e+00)		(1.2e+01)		(6.2e+00)	
f_{13}	3.2e+01	1.2e+01	−	3.3e+01	·	3.4e+01	·
	(1.2e+01)	(7.2e+00)		(1.3e+01)		(4.4e+00)	
f_{14}	3.9e+02	3.7e+01	−	4.0e+02	·	1.2e+03	+
	(1.8e+02)	(3.1e+01)		(2.2e+02)		(1.5e+02)	
f_{15}	1.5e+03	1.1e+03	−	1.4e+03	·	1.4e+03	·
	(3.6e+02)	(2.7e+02)		(3.0e+02)		(1.5e+02)	
f_{16}	1.7e+00	1.2e+00	−	1.6e+00	·	1.2e+00	−
	(4.2e−01)	(3.4e−01)		(4.4e−01)		(2.4e−01)	
f_{17}	2.5e+01	1.2e+01	−	2.3e+01	·	4.0e+01	+
	(8.6e+00)	(1.0e+00)		(7.5e+00)		(4.9e+00)	
f_{18}	4.7e+01	3.1e+01	−	4.6e+01	·	4.7e+01	·
	(1.3e+01)	(5.7e+00)		(1.3e+01)		(4.9e+00)	
f_{19}	1.4e+00	6.4e−01	−	1.4e+00	·	2.6e+00	+
	(4.4e−01)	(2.0e−01)		(5.1e−01)		(5.1e−01)	
f_{20}	3.4e+00	2.3e+00	−	3.5e+00	·	3.0e+00	−
	(4.9e−01)	(4.0e−01)		(4.1e−01)		(2.7e−01)	
f_{21}	3.7e+02	3.6e+02	·	3.7e+02	·	3.8e+02	·
	(7.4e+01)	(7.7e+01)		(7.6e+01)		(5.4e+01)	
f_{22}	4.0e+02	9.9e+01	−	4.7e+02	·	1.3e+03	+
	(1.8e+02)	(5.7e+01)		(2.2e+02)		(1.7e+02)	
f_{23}	1.4e+03	8.7e+02	−	1.5e+03	·	1.5e+03	·
	(3.6e+02)	(2.7e+02)		(4.2e+02)		(1.7e+02)	
f_{24}	2.1e+02	2.0e+02	−	2.1e+02	·	2.0e+02	−
	(1.2e+01)	(2.7e+01)		(1.4e+01)		(1.0e+01)	
f_{25}	2.1e+02	2.0e+02	−	2.1e+02	·	2.0e+02	·
	(4.5e+00)	(1.4e+01)		(5.6e+00)		(3.6e+00)	
f_{26}	1.7e+02	1.4e+02	·	1.7e+02	·	1.9e+02	+
	(5.7e+01)	(4.3e+01)		(4.8e+01)		(4.7e+01)	
f_{27}	3.7e+02	3.1e+02	−	3.7e+02	·	3.5e+02	·
	(9.8e+01)	(4.3e+01)		(9.6e+01)		(8.7e+01)	
f_{28}	2.9e+02	2.6e+02	·	2.8e+02	·	2.8e+02	+
	(7.9e+01)	(7.7e+01)		(6.0e+01)		(5.4e+01)	
Summary (+/·/−)		1/8/19		0/28/0		12/11/5	

Table 98: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	2.3e−01	3.5e−03	−	1.1e+02	+	2.7e−01	·
	(1.4e−01)	(2.2e−03)		(1.4e+02)		(1.4e−01)	
f_2	6.8e+05	2.3e+04	−	2.3e+06	·	1.0e+06	+
	(3.2e+05)	(1.4e+04)		(3.2e+06)		(3.1e+05)	
f_3	8.1e+07	4.2e+05	−	4.1e+08	·	2.3e+08	+
	(5.2e+07)	(3.1e+05)		(5.3e+08)		(9.2e+07)	
f_4	2.7e+03	1.4e+02	−	1.6e+04	+	3.8e+03	·
	(1.1e+03)	(9.2e+01)		(1.0e+04)		(1.3e+03)	
f_5	2.5e−01	1.3e−02	−	2.1e+01	+	3.0e−01	·
	(8.9e−02)	(6.1e−03)		(2.8e+01)		(8.5e−02)	
f_6	1.0e+00	1.5e−01	−	2.6e+01	+	2.2e+00	+
	(3.9e−01)	(5.6e−02)		(2.5e+01)		(1.2e+00)	
f_7	2.2e+01	2.4e+00	−	4.7e+01	+	2.9e+01	+
	(5.4e+00)	(1.2e+00)		(2.4e+01)		(6.1e+00)	
f_8	2.0e+01	2.0e+01	+	2.1e+01	+	2.0e+01	·
	(7.3e−02)	(8.1e−02)		(9.9e−02)		(7.5e−02)	
f_9	7.8e+00	1.9e+00	−	6.7e+00	−	8.7e+00	·
	(1.3e+00)	(7.9e−01)		(1.3e+00)		(5.8e−01)	
f_{10}	2.4e+00	9.7e−01	−	3.2e+01	+	2.6e+00	·
	(6.2e−01)	(1.3e−01)		(3.6e+01)		(6.3e−01)	
f_{11}	2.3e+01	7.9e−01	−	2.2e+01	·	4.3e+01	+
	(8.4e+00)	(6.9e−01)		(8.1e+00)		(5.1e+00)	
f_{12}	4.3e+01	9.6e+00	−	4.7e+01	·	4.8e+01	·
	(8.2e+00)	(3.4e+00)		(1.6e+01)		(6.9e+00)	
f_{13}	4.6e+01	1.8e+01	−	5.3e+01	·	5.0e+01	·
	(6.5e+00)	(7.9e+00)		(1.4e+01)		(5.4e+00)	
f_{14}	6.3e+02	4.0e+01	−	4.3e+02	·	1.3e+03	+
	(2.7e+02)	(1.8e+01)		(1.7e+02)		(1.4e+02)	
f_{15}	1.4e+03	9.6e+02	−	1.6e+03	+	1.5e+03	·
	(1.8e+02)	(3.9e+02)		(2.2e+02)		(1.3e+02)	
f_{16}	1.2e+00	1.3e+00	·	1.7e+00	+	1.2e+00	·
	(2.0e−01)	(2.4e−01)		(4.8e−01)		(1.8e−01)	
f_{17}	4.7e+01	1.5e+01	−	4.8e+01	·	6.6e+01	+
	(9.4e+00)	(2.2e+00)		(1.4e+01)		(9.5e+00)	
f_{18}	6.5e+01	3.3e+01	−	8.1e+01	+	7.2e+01	+
	(8.3e+00)	(1.1e+01)		(1.7e+01)		(7.7e+00)	
f_{19}	3.7e+00	8.2e−01	−	4.5e+00	·	4.3e+00	+
	(7.8e−01)	(2.4e−01)		(6.4e+00)		(6.5e−01)	
f_{20}	3.4e+00	2.6e+00	−	3.8e+00	+	3.4e+00	·
	(2.3e−01)	(4.0e−01)		(3.5e−01)		(2.4e−01)	
f_{21}	3.3e+02	2.8e+02	−	3.9e+02	+	3.8e+02	·
	(8.7e+01)	(1.0e+02)		(6.4e+01)		(3.3e+01)	
f_{22}	7.5e+02	1.1e+02	−	5.3e+02	−	1.5e+03	+
	(3.0e+02)	(5.5e+01)		(2.0e+02)		(1.5e+02)	
f_{23}	1.6e+03	7.4e+02	−	1.9e+03	+	1.7e+03	·
	(2.4e+02)	(4.4e+02)		(3.2e+02)		(1.4e+02)	
f_{24}	2.2e+02	2.0e+02	−	2.2e+02	·	2.2e+02	+
	(2.9e+00)	(1.8e+01)		(3.7e+00)		(8.5e+00)	
f_{25}	2.1e+02	2.0e+02	−	2.2e+02	·	2.2e+02	+
	(3.7e+00)	(1.8e+01)		(8.4e+00)		(9.1e+00)	
f_{26}	1.9e+02	1.5e+02	−	1.9e+02	+	1.9e+02	·
	(2.3e+01)	(4.2e+01)		(1.8e+01)		(2.4e+01)	
f_{27}	4.2e+02	3.2e+02	−	5.1e+02	+	5.3e+02	+
	(3.3e+01)	(6.4e+00)		(6.6e+01)		(3.7e+01)	
f_{28}	2.9e+02	2.2e+02	−	5.0e+02	+	2.9e+02	·
	(7.6e+01)	(9.9e+01)		(1.8e+02)		(9.0e+01)	
Summary (+/·/−)		1/1/26		16/10/2		13/15/0	

Table 99: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	1.9e+01	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(6.5e+01)		(0.0e+00)	
f_2	2.0e+02	3.0e+02	·	1.3e+05	·	1.4e+03	+
	(1.2e+02)	(2.0e+02)		(6.6e+05)		(6.4e+02)	
f_3	3.4e+03	3.0e+03	·	7.2e+07	·	4.5e+06	+
	(4.0e+03)	(4.3e+03)		(3.2e+08)		(2.9e+06)	
f_4	1.2e+00	1.5e+00	·	2.1e+03	·	8.5e+00	+
	(8.0e−01)	(9.6e−01)		(6.5e+03)		(3.0e+00)	
f_5	9.8e−08	1.6e−07	+	4.5e+00	+	2.4e−07	+
	(5.2e−08)	(7.1e−08)		(1.7e+01)		(1.1e−07)	
f_6	3.0e−04	4.3e−04	+	6.7e+00	+	8.7e−04	+
	(3.6e−04)	(3.4e−04)		(6.0e+00)		(4.7e−04)	
f_7	5.4e−01	4.6e−01	·	2.3e+01	+	1.1e+01	+
	(2.5e−01)	(2.3e−01)		(1.9e+01)		(2.5e+00)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(8.1e−02)	(8.0e−02)		(1.1e−01)		(6.2e−02)	
f_9	2.6e+00	1.2e+00	·	5.2e+00	+	8.7e+00	+
	(1.6e+00)	(8.2e−01)		(2.1e+00)		(5.5e−01)	
f_{10}	4.6e−01	2.5e−01	−	3.7e+00	·	6.3e−01	+
	(9.3e−02)	(1.4e−01)		(9.0e+00)		(8.3e−02)	
f_{11}	1.4e+01	1.1e+00	−	1.5e+01	·	3.1e+01	+
	(3.4e+00)	(1.3e+00)		(6.3e+00)		(4.0e+00)	
f_{12}	2.6e+01	9.8e+00	−	3.7e+01	+	3.7e+01	+
	(5.6e+00)	(5.0e+00)		(1.6e+01)		(4.6e+00)	
f_{13}	2.7e+01	1.4e+01	−	4.5e+01	+	3.5e+01	+
	(7.0e+00)	(7.6e+00)		(1.1e+01)		(6.0e+00)	
f_{14}	1.2e+03	3.8e+01	−	4.2e+02	−	1.3e+03	·
	(1.5e+02)	(2.5e+01)		(1.9e+02)		(1.1e+02)	
f_{15}	1.4e+03	1.1e+03	−	1.6e+03	+	1.5e+03	·
	(1.3e+02)	(3.0e+02)		(3.2e+02)		(1.2e+02)	
f_{16}	1.2e+00	1.2e+00	·	1.8e+00	+	1.2e+00	·
	(2.0e−01)	(3.2e−01)		(3.5e−01)		(1.8e−01)	
f_{17}	4.1e+01	1.4e+01	−	3.5e+01	−	4.5e+01	·
	(4.1e+00)	(1.3e+00)		(1.3e+01)		(4.5e+00)	
f_{18}	4.7e+01	3.6e+01	−	6.1e+01	+	4.9e+01	·
	(4.5e+00)	(9.5e+00)		(1.3e+01)		(7.0e+00)	
f_{19}	2.4e+00	6.8e−01	−	2.0e+00	−	3.0e+00	+
	(3.5e−01)	(2.0e−01)		(1.1e+00)		(4.6e−01)	
f_{20}	3.1e+00	2.6e+00	−	3.7e+00	+	3.2e+00	·
	(2.6e−01)	(4.3e−01)		(3.1e−01)		(2.0e−01)	
f_{21}	3.3e+02	3.2e+02	·	3.5e+02	+	4.0e+02	+
	(9.5e+01)	(9.9e+01)		(8.6e+01)		(8.4e−10)	
f_{22}	1.3e+03	1.1e+02	−	5.5e+02	−	1.5e+03	+
	(1.8e+02)	(5.2e+01)		(2.1e+02)		(1.4e+02)	
f_{23}	1.5e+03	1.0e+03	−	1.6e+03	·	1.6e+03	·
	(1.8e+02)	(3.9e+02)		(3.2e+02)		(1.7e+02)	
f_{24}	2.0e+02	2.0e+02	·	2.1e+02	+	2.2e+02	+
	(2.1e+01)	(1.9e+01)		(1.1e+01)		(2.3e+00)	
f_{25}	2.0e+02	2.0e+02	·	2.1e+02	+	2.2e+02	+
	(1.8e+00)	(2.0e+00)		(6.0e+00)		(2.2e+00)	
f_{26}	1.5e+02	1.5e+02	·	1.8e+02	·	1.8e+02	+
	(2.8e+01)	(4.2e+01)		(3.1e+01)		(2.1e+01)	
f_{27}	3.0e+02	3.0e+02	·	4.4e+02	+	3.6e+02	+
	(7.9e−01)	(1.0e+00)		(1.0e+02)		(4.5e+01)	
f_{28}	2.8e+02	2.7e+02	·	3.2e+02	+	3.0e+02	+
	(6.0e+01)	(7.3e+01)		(1.1e+02)		(2.9e−04)	
Summary (+/·/−)		2/14/12		17/7/4		19/9/0	

Table 100: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	0.0e+00	1.3e−07	+	1.6e−05	+	7.3e+02	+
	(0.0e+00)	(1.1e−07)		(4.9e−05)		(2.0e+03)	
f_3	5.1e−01	1.7e−01	+	1.5e+05	·	5.8e+06	+
	(1.7e+00)	(1.8e−01)		(1.1e+06)		(1.1e+07)	
f_4	0.0e+00	0.0e+00	·	9.7e−07	+	7.2e−01	+
	(0.0e+00)	(0.0e+00)		(4.9e−06)		(9.0e−01)	
f_5	0.0e+00	0.0e+00	·	0.0e+00	·	1.2e−08	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(2.6e−08)	
f_6	3.7e+00	3.8e−01	·	3.3e+00	·	1.9e−04	·
	(4.8e+00)	(1.9e+00)		(4.5e+00)		(1.0e−03)	
f_7	2.6e−01	1.3e−03	−	9.1e+00	+	1.4e+01	+
	(8.4e−01)	(1.1e−03)		(1.1e+01)		(6.6e+00)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(6.2e−02)	(9.5e−02)		(1.0e−01)		(7.4e−02)	
f_9	1.7e+00	7.7e−01	·	3.6e+00	+	6.4e+00	+
	(1.2e+00)	(9.3e−01)		(2.2e+00)		(2.7e+00)	
f_{10}	1.2e−01	9.6e−02	·	2.7e−01	+	8.6e−01	+
	(5.8e−02)	(7.6e−02)		(1.9e−01)		(1.2e−01)	
f_{11}	5.7e+00	6.5e−01	−	1.1e+01	+	3.7e+01	+
	(2.5e+00)	(1.0e+00)		(6.2e+00)		(5.6e+00)	
f_{12}	1.1e+01	1.0e+01	·	2.2e+01	+	4.4e+01	+
	(4.6e+00)	(5.3e+00)		(1.2e+01)		(8.1e+00)	
f_{13}	1.9e+01	1.3e+01	−	3.3e+01	+	4.3e+01	+
	(7.8e+00)	(6.3e+00)		(1.3e+01)		(7.1e+00)	
f_{14}	3.9e+02	3.4e+01	−	4.2e+02	·	1.2e+03	+
	(3.6e+02)	(2.2e+01)		(2.2e+02)		(1.4e+02)	
f_{15}	1.1e+03	1.0e+03	·	1.5e+03	+	1.5e+03	+
	(3.8e+02)	(2.9e+02)		(2.6e+02)		(1.4e+02)	
f_{16}	1.1e+00	1.2e+00	·	1.7e+00	+	1.1e+00	·
	(2.0e−01)	(2.2e−01)		(4.2e−01)		(2.2e−01)	
f_{17}	2.7e+01	1.2e+01	−	2.5e+01	·	4.8e+01	+
	(9.5e+00)	(1.0e+00)		(8.1e+00)		(7.6e+00)	
f_{18}	3.8e+01	3.2e+01	·	4.7e+01	+	5.6e+01	+
	(8.6e+00)	(6.3e+00)		(1.1e+01)		(8.2e+00)	
f_{19}	7.4e−01	6.6e−01	·	1.3e+00	+	3.5e+00	+
	(3.3e−01)	(1.9e−01)		(6.2e−01)		(6.6e−01)	
f_{20}	2.3e+00	2.3e+00	·	3.6e+00	+	3.3e+00	+
	(5.7e−01)	(4.0e−01)		(3.5e−01)		(2.8e−01)	
f_{21}	3.8e+02	3.6e+02	·	3.6e+02	·	3.5e+02	·
	(6.5e+01)	(8.0e+01)		(7.8e+01)		(9.3e+01)	
f_{22}	2.2e+02	9.1e+01	−	4.5e+02	+	1.3e+03	+
	(2.0e+02)	(4.5e+01)		(2.0e+02)		(2.3e+02)	
f_{23}	6.6e+02	9.2e+02	+	1.6e+03	+	1.5e+03	+
	(2.6e+02)	(3.2e+02)		(3.2e+02)		(1.8e+02)	
f_{24}	2.1e+02	2.0e+02	−	2.1e+02	·	2.1e+02	·
	(4.1e+00)	(1.4e+01)		(4.7e+00)		(5.6e+00)	
f_{25}	2.0e+02	2.0e+02	−	2.1e+02	·	2.1e+02	·
	(1.4e+01)	(2.1e+01)		(1.1e+01)		(1.0e+01)	
f_{26}	1.7e+02	1.4e+02	·	1.8e+02	+	1.9e+02	+
	(4.6e+01)	(4.5e+01)		(4.5e+01)		(4.1e+01)	
f_{27}	3.5e+02	3.0e+02	−	4.1e+02	+	3.9e+02	+
	(8.5e+01)	(2.0e−03)		(1.1e+02)		(9.9e+01)	
f_{28}	2.7e+02	2.8e+02	·	2.9e+02	·	2.9e+02	+
	(7.0e+01)	(5.4e+01)		(3.9e+01)		(4.8e+01)	
Summary (+/·/−)		3/16/9		18/10/0		20/8/0	

Table 101: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.8e−06	5.8e−08	−	4.6e+01	+	1.0e−07	−
	(1.0e−06)	(4.3e−08)		(1.1e+02)		(5.4e−08)	
f_2	9.3e+03	1.2e+03	−	4.3e+05	·	1.3e+04	·
	(5.0e+03)	(6.3e+02)		(1.4e+06)		(5.2e+03)	
f_3	1.2e+05	1.4e+04	−	1.3e+08	·	1.4e+07	+
	(9.9e+04)	(2.4e+04)		(4.1e+08)		(7.7e+06)	
f_4	5.4e+01	6.4e+00	−	4.9e+03	·	5.4e+01	·
	(3.3e+01)	(3.6e+00)		(9.6e+03)		(2.4e+01)	
f_5	7.0e−05	6.2e−06	−	5.5e+00	+	1.3e−05	−
	(3.4e−05)	(3.2e−06)		(1.1e+01)		(4.2e−06)	
f_6	1.0e−02	2.3e−03	−	7.6e+00	+	8.3e−03	−
	(4.8e−03)	(1.1e−03)		(1.2e+01)		(3.6e−03)	
f_7	2.7e+00	6.6e−01	−	2.7e+01	+	1.4e+01	+
	(1.2e+00)	(3.9e−01)		(2.0e+01)		(3.0e+00)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(7.8e−02)	(8.3e−02)		(1.2e−01)		(6.4e−02)	
f_9	3.0e+00	1.4e+00	−	6.0e+00	+	8.5e+00	+
	(1.0e+00)	(8.2e−01)		(2.1e+00)		(6.4e−01)	
f_{10}	5.9e−01	3.8e−01	−	8.1e+00	+	6.8e−01	+
	(1.1e−01)	(1.4e−01)		(1.9e+01)		(7.6e−02)	
f_{11}	7.0e+00	5.1e−01	−	1.7e+01	+	3.2e+01	+
	(2.4e+00)	(7.4e−01)		(5.8e+00)		(4.0e+00)	
f_{12}	1.7e+01	7.4e+00	−	3.7e+01	+	3.7e+01	+
	(7.9e+00)	(3.8e+00)		(1.2e+01)		(5.6e+00)	
f_{13}	2.1e+01	1.2e+01	−	4.9e+01	+	3.9e+01	+
	(7.4e+00)	(6.2e+00)		(1.3e+01)		(5.0e+00)	
f_{14}	1.1e+03	4.1e+01	−	4.2e+02	−	1.3e+03	+
	(1.6e+02)	(2.6e+01)		(1.7e+02)		(1.5e+02)	
f_{15}	1.4e+03	1.0e+03	−	1.6e+03	+	1.5e+03	+
	(1.4e+02)	(3.4e+02)		(2.5e+02)		(1.3e+02)	
f_{16}	1.1e+00	1.3e+00	+	1.7e+00	+	1.2e+00	·
	(1.8e−01)	(2.8e−01)		(3.7e−01)		(2.3e−01)	
f_{17}	4.1e+01	1.4e+01	−	3.7e+01	·	4.6e+01	+
	(5.2e+00)	(1.5e+00)		(1.3e+01)		(4.9e+00)	
f_{18}	5.1e+01	3.6e+01	−	6.2e+01	+	5.1e+01	·
	(7.1e+00)	(1.1e+01)		(1.4e+01)		(5.7e+00)	
f_{19}	2.5e+00	7.7e−01	−	2.8e+00	·	3.1e+00	+
	(4.8e−01)	(2.2e−01)		(3.8e+00)		(4.5e−01)	
f_{20}	3.2e+00	2.6e+00	−	3.7e+00	+	3.3e+00	·
	(1.7e−01)	(4.8e−01)		(3.8e−01)		(1.8e−01)	
f_{21}	2.9e+02	2.9e+02	−	3.8e+02	+	3.8e+02	·
	(1.0e+02)	(1.0e+02)		(6.1e+01)		(6.0e+01)	
f_{22}	1.2e+03	1.2e+02	−	5.6e+02	−	1.5e+03	+
	(2.2e+02)	(5.5e+01)		(2.4e+02)		(1.3e+02)	
f_{23}	1.5e+03	9.2e+02	−	1.8e+03	+	1.6e+03	+
	(2.0e+02)	(4.3e+02)		(3.2e+02)		(1.9e+02)	
f_{24}	2.1e+02	2.0e+02	−	2.1e+02	+	2.2e+02	+
	(1.7e+01)	(1.9e+01)		(5.6e+00)		(1.7e+00)	
f_{25}	2.0e+02	2.0e+02	−	2.1e+02	+	2.2e+02	+
	(9.7e+00)	(1.7e+01)		(5.3e+00)		(1.7e+00)	
f_{26}	1.7e+02	1.6e+02	·	1.8e+02	·	1.8e+02	·
	(3.2e+01)	(4.3e+01)		(3.1e+01)		(2.0e+01)	
f_{27}	3.2e+02	3.1e+02	−	4.5e+02	+	4.3e+02	+
	(4.2e+00)	(1.3e+00)		(1.0e+02)		(5.1e+01)	
f_{28}	2.3e+02	2.3e+02	−	3.7e+02	+	3.0e+02	·
	(9.8e+01)	(9.5e+01)		(1.5e+02)		(3.9e−03)	
Summary (+/·/−)		1/2/25		20/6/2		16/9/3	

Table 102: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	3.9e−04	·	2.0e−05	+
	(0.0e+00)	(0.0e+00)		(2.8e−03)		(2.5e−05)	
f_2	0.0e+00	1.1e−02	+	8.5e+03	+	2.4e+05	+
	(0.0e+00)	(1.1e−02)		(6.0e+04)		(5.5e+05)	
f_3	3.3e−01	1.1e+00	+	9.0e+05	·	2.0e+08	+
	(1.3e+00)	(2.5e+00)		(4.3e+06)		(1.7e+08)	
f_4	0.0e+00	7.4e−05	+	1.4e−03	+	7.0e+02	+
	(0.0e+00)	(4.6e−05)		(8.0e−03)		(7.7e+02)	
f_5	0.0e+00	0.0e+00	·	2.2e−04	·	2.7e−03	+
	(0.0e+00)	(0.0e+00)		(1.3e−03)		(3.4e−03)	
f_6	9.6e−01	1.9e−08	·	4.6e+00	·	3.7e−01	+
	(2.9e+00)	(6.4e−08)		(4.8e+00)		(1.0e+00)	
f_7	1.1e−02	2.7e−02	+	1.8e+01	+	2.7e+01	+
	(3.2e−02)	(1.4e−02)		(1.7e+01)		(7.9e+00)	
f_8	2.0e+01	2.0e+01	·	2.1e+01	+	2.0e+01	·
	(8.3e−02)	(8.0e−02)		(1.3e−01)		(8.1e−02)	
f_9	1.3e+00	1.0e+00	·	3.9e+00	+	7.9e+00	+
	(9.1e−01)	(9.6e−01)		(1.7e+00)		(1.4e+00)	
f_{10}	7.3e−02	1.4e−01	+	2.7e−01	+	9.9e−01	+
	(4.2e−02)	(9.8e−02)		(1.7e−01)		(1.1e−01)	
f_{11}	3.2e+00	1.4e+00	−	6.3e+00	+	4.3e+01	+
	(1.6e+00)	(1.1e+00)		(3.4e+00)		(6.3e+00)	
f_{12}	8.3e+00	1.1e+01	+	2.2e+01	+	4.8e+01	+
	(3.2e+00)	(5.3e+00)		(8.7e+00)		(8.3e+00)	
f_{13}	1.4e+01	1.6e+01	·	3.0e+01	+	5.1e+01	+
	(7.0e+00)	(6.6e+00)		(1.2e+01)		(8.4e+00)	
f_{14}	7.9e+02	4.2e+01	−	2.6e+02	−	1.2e+03	+
	(4.0e+02)	(3.8e+01)		(1.5e+02)		(1.6e+02)	
f_{15}	1.2e+03	1.1e+03	·	9.0e+02	−	1.5e+03	+
	(2.7e+02)	(2.8e+02)		(3.9e+02)		(1.3e+02)	
f_{16}	1.2e+00	1.2e+00	·	1.7e+00	+	1.2e+00	·
	(2.0e−01)	(2.9e−01)		(4.1e−01)		(2.3e−01)	
f_{17}	3.2e+01	1.3e+01	−	2.1e+01	−	6.1e+01	+
	(5.5e+00)	(9.7e−01)		(8.0e+00)		(1.0e+01)	
f_{18}	4.2e+01	3.5e+01	−	3.9e+01	·	6.6e+01	+
	(5.0e+00)	(6.4e+00)		(1.6e+01)		(1.1e+01)	
f_{19}	9.4e−01	6.7e−01	·	1.2e+00	·	4.3e+00	+
	(4.1e−01)	(1.8e−01)		(4.6e−01)		(9.1e−01)	
f_{20}	2.5e+00	2.5e+00	·	3.4e+00	+	3.5e+00	+
	(3.0e−01)	(3.3e−01)		(4.8e−01)		(2.8e−01)	
f_{21}	3.5e+02	3.5e+02	·	3.6e+02	·	3.5e+02	+
	(9.0e+01)	(9.3e+01)		(8.7e+01)		(9.0e+01)	
f_{22}	3.1e+02	1.1e+02	·	3.2e+02	·	1.3e+03	+
	(3.0e+02)	(6.1e+01)		(2.0e+02)		(1.7e+02)	
f_{23}	8.3e+02	1.0e+03	·	1.2e+03	·	1.5e+03	+
	(4.9e+02)	(2.8e+02)		(3.9e+02)		(1.9e+02)	
f_{24}	2.0e+02	2.0e+02	·	2.1e+02	+	2.2e+02	+
	(4.2e+00)	(2.3e+01)		(5.1e+00)		(4.8e+00)	
f_{25}	2.0e+02	2.0e+02	·	2.1e+02	+	2.1e+02	+
	(3.2e+00)	(2.3e+00)		(4.7e+00)		(1.0e+01)	
f_{26}	1.8e+02	1.4e+02	·	1.8e+02	+	1.8e+02	+
	(5.4e+01)	(4.3e+01)		(5.3e+01)		(2.8e+01)	
f_{27}	3.5e+02	3.1e+02	+	4.0e+02	+	4.4e+02	+
	(8.0e+01)	(3.7e+01)		(1.0e+02)		(8.7e+01)	
f_{28}	2.9e+02	2.7e+02	+	2.9e+02	+	2.7e+02	+
	(3.9e+01)	(7.0e+01)		(1.0e+02)		(7.0e+01)	
Summary (+/·/−)		8/16/4		16/9/3		26/2/0	

Table 103: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	1.1e+06	1.1e+06	·	6.7e+05	−	1.3e+05	−
	(5.9e+05)	(6.2e+05)		(3.9e+05)		(4.8e+04)	
f_3	1.5e+06	1.8e+06	·	6.4e+06	·	1.2e−02	−
	(2.8e+06)	(2.5e+06)		(1.8e+07)		(5.9e−02)	
f_4	6.0e+03	6.4e+03	·	4.1e+03	−	1.6e+03	−
	(1.6e+03)	(2.1e+03)		(1.3e+03)		(3.9e+02)	
f_5	4.2e−06	2.0e−08	·	0.0e+00	·	0.0e+00	·
	(3.0e−05)	(1.1e−07)		(0.0e+00)		(0.0e+00)	
f_6	2.3e+01	2.4e+01	·	1.1e+01	−	1.6e+01	−
	(1.2e+01)	(1.2e+01)		(8.0e+00)		(4.9e−01)	
f_7	5.9e−01	3.3e−01	·	2.2e+01	+	3.7e−02	−
	(6.2e−01)	(4.3e−01)		(1.5e+01)		(1.9e−02)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.6e−02)	(4.6e−02)		(4.6e−02)		(4.9e−02)	
f_9	1.4e+01	1.6e+01	·	1.4e+01	·	3.9e+01	+
	(9.5e+00)	(1.1e+01)		(4.1e+00)		(1.3e+00)	
f_{10}	7.9e−02	1.3e−01	·	2.2e−02	−	0.0e+00	−
	(3.5e−02)	(2.4e−01)		(2.2e−02)		(0.0e+00)	
f_{11}	1.0e+02	1.0e+02	·	6.5e+01	−	1.5e+02	+
	(1.1e+01)	(1.0e+01)		(1.5e+01)		(9.6e+00)	
f_{12}	1.6e+02	1.6e+02	·	6.9e+01	−	1.7e+02	·
	(1.0e+01)	(9.2e+00)		(2.2e+01)		(9.9e+00)	
f_{13}	1.6e+02	1.6e+02	·	1.3e+02	−	1.7e+02	·
	(8.9e+00)	(8.5e+00)		(3.0e+01)		(9.0e+00)	
f_{14}	5.0e+03	4.9e+03	·	1.9e+03	−	6.8e+03	+
	(2.7e+02)	(3.5e+02)		(4.4e+02)		(2.7e+02)	
f_{15}	7.1e+03	7.0e+03	·	4.6e+03	−	7.1e+03	·
	(2.3e+02)	(2.6e+02)		(7.7e+02)		(2.4e+02)	
f_{16}	2.5e+00	2.5e+00	·	2.0e+00	−	2.4e+00	·
	(2.5e−01)	(2.7e−01)		(5.5e−01)		(3.1e−01)	
f_{17}	1.5e+02	1.5e+02	·	1.1e+02	−	1.8e+02	+
	(1.0e+01)	(9.5e+00)		(1.8e+01)		(8.1e+00)	
f_{18}	1.9e+02	1.9e+02	·	1.4e+02	−	2.0e+02	·
	(1.0e+01)	(9.9e+00)		(3.0e+01)		(9.8e+00)	
f_{19}	1.3e+01	1.3e+01	·	4.9e+00	−	1.4e+01	+
	(8.2e−01)	(7.9e−01)		(1.2e+00)		(9.5e−01)	
f_{20}	1.2e+01	1.2e+01	·	1.2e+01	·	1.2e+01	·
	(2.6e−01)	(2.7e−01)		(6.7e−01)		(2.3e−01)	
f_{21}	2.9e+02	3.0e+02	·	3.1e+02	+	2.9e+02	−
	(6.4e+01)	(7.5e+01)		(7.6e+01)		(5.8e+01)	
f_{22}	5.2e+03	5.2e+03	·	2.1e+03	−	6.6e+03	+
	(4.3e+02)	(3.4e+02)		(4.3e+02)		(2.5e+02)	
f_{23}	7.0e+03	7.0e+03	·	4.3e+03	−	7.0e+03	·
	(2.4e+02)	(3.1e+02)		(7.2e+02)		(3.2e+02)	
f_{24}	2.0e+02	2.0e+02	·	2.4e+02	+	2.0e+02	−
	(6.6e+00)	(5.1e+00)		(1.1e+01)		(7.5e−03)	
f_{25}	2.4e+02	2.4e+02	·	2.5e+02	+	2.3e+02	−
	(4.4e+00)	(4.6e+00)		(7.8e+00)		(1.8e+01)	
f_{26}	2.0e+02	2.0e+02	·	2.5e+02	+	2.1e+02	−
	(2.7e−02)	(2.2e−02)		(6.4e+01)		(2.5e+01)	
f_{27}	3.6e+02	3.5e+02	·	6.6e+02	+	3.0e+02	−
	(9.2e+01)	(7.9e+01)		(8.9e+01)		(2.4e−01)	
f_{28}	3.0e+02	3.0e+02	·	3.9e+02	+	3.0e+02	−
	(9.9e−11)	(7.7e−11)		(2.9e+02)		(5.1e−13)	
Summary (+/·/−)		0/28/0		7/6/15		6/10/12	

Table 104: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	2.7e+06	1.9e+06	−	1.1e+06	−	2.5e+06	·
	(9.5e+05)	(6.6e+05)		(6.1e+05)		(4.5e+05)	
f_3	3.5e+04	2.9e+03	−	1.9e+07	+	5.1e+04	+
	(2.2e+04)	(3.1e+03)		(4.0e+07)		(2.3e+04)	
f_4	2.3e+04	1.7e+04	−	7.6e+03	−	1.5e+04	−
	(3.7e+03)	(3.3e+03)		(3.1e+03)		(1.9e+03)	
f_5	1.7e−07	2.1e−09	−	4.2e−07	+	0.0e+00	−
	(5.5e−08)	(4.7e−09)		(3.2e−07)		(0.0e+00)	
f_6	1.5e+01	1.5e+01	·	1.8e+01	·	8.9e+00	−
	(3.4e+00)	(3.0e+00)		(1.5e+01)		(2.5e+00)	
f_7	3.5e+00	1.4e+00	−	2.0e+01	+	9.9e+00	+
	(1.1e+00)	(8.0e−01)		(1.5e+01)		(1.5e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.8e−02)	(5.2e−02)		(5.6e−02)		(5.5e−02)	
f_9	3.8e+01	3.8e+01	·	1.5e+01	−	3.9e+01	+
	(1.3e+00)	(3.5e+00)		(4.4e+00)		(1.1e+00)	
f_{10}	2.9e−02	2.3e−03	−	2.0e−02	·	6.3e−03	−
	(3.1e−02)	(3.9e−03)		(1.4e−02)		(3.0e−03)	
f_{11}	1.7e+02	1.2e+02	−	6.2e+01	−	1.7e+02	·
	(1.1e+01)	(1.0e+01)		(1.7e+01)		(1.1e+01)	
f_{12}	1.8e+02	1.8e+02	·	6.2e+01	−	1.9e+02	·
	(8.6e+00)	(9.3e+00)		(1.9e+01)		(7.9e+00)	
f_{13}	1.9e+02	1.8e+02	−	1.2e+02	−	1.9e+02	·
	(1.2e+01)	(8.7e+00)		(2.7e+01)		(1.0e+01)	
f_{14}	6.7e+03	5.1e+03	−	1.9e+03	−	6.8e+03	·
	(3.2e+02)	(3.4e+02)		(5.2e+02)		(2.2e+02)	
f_{15}	7.1e+03	7.1e+03	·	4.7e+03	−	7.1e+03	·
	(2.3e+02)	(2.6e+02)		(8.3e+02)		(3.0e+02)	
f_{16}	2.5e+00	2.4e+00	·	2.0e+00	−	2.5e+00	·
	(2.3e−01)	(2.6e−01)		(4.6e−01)		(2.5e−01)	
f_{17}	2.0e+02	1.6e+02	−	1.1e+02	−	2.1e+02	·
	(1.0e+01)	(1.0e+01)		(1.8e+01)		(1.0e+01)	
f_{18}	2.2e+02	2.1e+02	·	1.4e+02	−	2.2e+02	·
	(1.1e+01)	(9.8e+00)		(2.8e+01)		(1.1e+01)	
f_{19}	1.6e+01	1.4e+01	−	5.5e+00	−	1.6e+01	·
	(9.1e−01)	(7.6e−01)		(1.4e+00)		(9.3e−01)	
f_{20}	1.2e+01	1.2e+01	·	1.2e+01	−	1.2e+01	·
	(2.2e−01)	(2.2e−01)		(6.1e−01)		(2.0e−01)	
f_{21}	2.8e+02	2.8e+02	·	2.8e+02	·	2.8e+02	·
	(7.6e+01)	(7.0e+01)		(6.6e+01)		(7.6e+01)	
f_{22}	6.8e+03	5.3e+03	−	2.0e+03	−	6.8e+03	·
	(3.1e+02)	(4.2e+02)		(4.1e+02)		(3.1e+02)	
f_{23}	7.1e+03	7.1e+03	·	4.9e+03	−	7.1e+03	·
	(3.1e+02)	(2.5e+02)		(8.1e+02)		(2.1e+02)	
f_{24}	2.0e+02	2.0e+02	−	2.4e+02	+	2.1e+02	+
	(2.4e+00)	(2.5e−01)		(1.0e+01)		(6.2e−01)	
f_{25}	2.5e+02	2.4e+02	·	2.6e+02	+	2.7e+02	+
	(1.1e+01)	(5.1e+00)		(7.4e+00)		(1.7e+01)	
f_{26}	2.0e+02	2.0e+02	−	2.4e+02	·	2.0e+02	·
	(3.8e−02)	(2.4e−02)		(5.9e+01)		(2.5e+01)	
f_{27}	6.0e+02	3.8e+02	−	6.7e+02	+	4.6e+02	·
	(2.2e+02)	(8.3e+01)		(7.7e+01)		(3.5e+01)	
f_{28}	3.0e+02	3.0e+02	−	3.2e+02	−	3.0e+02	−
	(1.5e−04)	(1.6e−05)		(1.5e+02)		(1.5e−06)	
Summary (+/·/−)		0/12/16		6/6/16		5/18/5	

Table 105: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.9e+04	1.7e+04	−	1.8e+04	·	2.1e+04	·
	(4.0e+03)	(2.3e+03)		(4.2e+03)		(4.9e+03)	
f_2	1.6e+08	2.8e+08	+	1.6e+08	·	1.6e+08	·
	(8.4e+07)	(4.9e+07)		(8.5e+07)		(7.7e+07)	
f_3	1.2e+12	8.5e+10	·	7.6e+11	·	7.0e+11	·
	(4.4e+12)	(2.3e+10)		(2.3e+12)		(1.3e+12)	
f_4	3.4e−01	7.5e+04	+	2.2e−01	·	1.4e−02	−
	(1.0e+00)	(8.1e+03)		(3.8e−01)		(2.9e−02)	
f_5	3.7e+03	3.1e+03	·	3.9e+03	·	4.5e+03	·
	(1.6e+03)	(6.2e+02)		(1.3e+03)		(1.8e+03)	
f_6	1.7e+03	1.4e+03	·	1.7e+03	·	1.8e+03	·
	(5.6e+02)	(2.6e+02)		(5.5e+02)		(5.7e+02)	
f_7	3.9e+02	2.7e+02	·	3.8e+02	·	4.3e+02	·
	(5.3e+02)	(3.6e+01)		(6.0e+02)		(5.3e+02)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	−
	(4.9e−02)	(5.8e−02)		(5.7e−02)		(5.8e−02)	
f_9	2.9e+01	3.9e+01	+	3.0e+01	·	2.6e+01	−
	(3.4e+00)	(1.1e+00)		(3.2e+00)		(2.9e+00)	
f_{10}	2.3e+03	2.5e+03	·	2.3e+03	·	2.5e+03	·
	(6.6e+02)	(3.5e+02)		(6.7e+02)		(7.6e+02)	
f_{11}	3.6e+02	4.0e+02	·	3.6e+02	·	3.7e+02	·
	(8.1e+01)	(2.9e+01)		(7.4e+01)		(6.9e+01)	
f_{12}	3.8e+02	4.6e+02	+	3.6e+02	·	3.7e+02	·
	(7.8e+01)	(3.0e+01)		(6.3e+01)		(7.3e+01)	
f_{13}	4.6e+02	4.5e+02	·	4.7e+02	·	4.5e+02	·
	(8.2e+01)	(3.5e+01)		(7.6e+01)		(7.9e+01)	
f_{14}	3.9e+03	5.3e+03	+	3.9e+03	·	3.9e+03	·
	(5.7e+02)	(3.4e+02)		(5.3e+02)		(5.5e+02)	
f_{15}	4.5e+03	7.3e+03	+	4.5e+03	·	3.7e+03	−
	(6.3e+02)	(3.7e+02)		(6.8e+02)		(5.4e+02)	
f_{16}	1.0e+00	2.5e+00	+	1.1e+00	·	2.5e+00	+
	(4.1e−01)	(2.6e−01)		(4.1e−01)		(3.1e−01)	
f_{17}	6.2e+02	8.5e+02	+	6.5e+02	·	6.8e+02	·
	(1.3e+02)	(6.9e+01)		(1.1e+02)		(9.4e+01)	
f_{18}	6.6e+02	8.5e+02	+	6.6e+02	·	6.7e+02	·
	(1.1e+02)	(7.9e+01)		(1.3e+02)		(1.1e+02)	
f_{19}	4.7e+04	2.7e+04	·	5.3e+04	·	5.8e+04	·
	(5.1e+04)	(1.2e+04)		(5.6e+04)		(4.8e+04)	
f_{20}	1.3e+01	1.4e+01	+	1.4e+01	·	1.3e+01	·
	(1.2e+00)	(2.6e−01)		(1.1e+00)		(1.3e+00)	
f_{21}	2.1e+03	2.6e+03	+	2.2e+03	·	2.1e+03	·
	(3.1e+02)	(1.6e+02)		(2.8e+02)		(3.1e+02)	
f_{22}	4.7e+03	6.1e+03	+	4.7e+03	·	4.6e+03	·
	(8.0e+02)	(3.4e+02)		(8.0e+02)		(6.5e+02)	
f_{23}	5.5e+03	8.0e+03	+	5.7e+03	·	4.5e+03	−
	(8.3e+02)	(2.7e+02)		(8.1e+02)		(7.5e+02)	
f_{24}	3.1e+02	3.2e+02	+	3.1e+02	·	3.1e+02	·
	(9.0e+00)	(4.4e+00)		(9.3e+00)		(8.4e+00)	
f_{25}	3.3e+02	3.4e+02	+	3.3e+02	·	3.2e+02	·
	(1.1e+01)	(4.2e+00)		(1.1e+01)		(9.3e+00)	
f_{26}	3.3e+02	2.3e+02	·	3.2e+02	·	3.2e+02	−
	(7.9e+01)	(7.7e+00)		(8.2e+01)		(8.0e+01)	
f_{27}	1.2e+03	1.4e+03	+	1.2e+03	·	1.1e+03	·
	(6.9e+01)	(3.5e+01)		(8.6e+01)		(7.2e+01)	
f_{28}	3.5e+03	3.4e+03	·	3.4e+03	·	3.5e+03	·
	(5.4e+02)	(2.5e+02)		(5.6e+02)		(4.5e+02)	
Summary (+/·/−)		16/11/1		0/28/0		1/21/6	

Table 106: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	5.9e+03	1.4e+04	+	5.9e+03	·	6.6e+03	·
	(2.0e+03)	(1.9e+03)		(2.1e+03)		(2.2e+03)	
f_2	4.6e+07	2.4e+08	+	4.8e+07	·	3.9e+07	·
	(2.6e+07)	(5.5e+07)		(2.5e+07)		(2.4e+07)	
f_3	1.7e+10	6.5e+10	+	1.8e+10	·	1.1e+10	·
	(3.2e+10)	(1.4e+10)		(4.1e+10)		(1.8e+10)	
f_4	6.7e−03	7.2e+04	+	8.0e−03	·	4.1e−03	·
	(1.7e−02)	(8.9e+03)		(1.4e−02)		(7.6e−03)	
f_5	1.6e+03	2.6e+03	+	1.4e+03	·	1.6e+03	·
	(6.4e+02)	(4.0e+02)		(5.9e+02)		(8.3e+02)	
f_6	4.7e+02	1.2e+03	+	5.1e+02	·	4.7e+02	·
	(2.2e+02)	(2.4e+02)		(1.7e+02)		(1.6e+02)	
f_7	1.3e+02	2.4e+02	+	1.5e+02	·	1.2e+02	·
	(3.6e+01)	(2.7e+01)		(3.6e+01)		(4.9e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.1e−02)	(4.2e−02)		(5.6e−02)		(4.9e−02)	
f_9	2.3e+01	4.0e+01	+	2.5e+01	·	2.1e+01	−
	(2.8e+00)	(1.1e+00)		(2.9e+00)		(2.7e+00)	
f_{10}	9.7e+02	2.2e+03	+	1.0e+03	·	1.1e+03	·
	(3.4e+02)	(3.4e+02)		(3.4e+02)		(3.2e+02)	
f_{11}	2.3e+02	3.7e+02	+	2.4e+02	·	2.1e+02	·
	(6.8e+01)	(3.1e+01)		(6.1e+01)		(6.0e+01)	
f_{12}	2.1e+02	4.2e+02	+	2.3e+02	+	2.1e+02	·
	(5.3e+01)	(3.4e+01)		(5.4e+01)		(5.1e+01)	
f_{13}	3.1e+02	4.2e+02	+	3.2e+02	·	3.0e+02	·
	(7.3e+01)	(2.8e+01)		(5.5e+01)		(5.4e+01)	
f_{14}	3.1e+03	5.3e+03	+	3.3e+03	·	2.6e+03	−
	(5.1e+02)	(3.9e+02)		(4.4e+02)		(6.2e+02)	
f_{15}	3.5e+03	7.3e+03	+	4.0e+03	+	4.1e+03	·
	(7.7e+02)	(3.2e+02)		(6.6e+02)		(1.9e+03)	
f_{16}	2.5e+00	2.5e+00	·	1.5e+00	−	2.5e+00	·
	(2.5e−01)	(2.5e−01)		(4.2e−01)		(2.6e−01)	
f_{17}	3.0e+02	7.9e+02	+	3.3e+02	·	3.0e+02	·
	(5.9e+01)	(6.3e+01)		(8.0e+01)		(6.0e+01)	
f_{18}	3.4e+02	7.8e+02	+	3.8e+02	·	3.7e+02	·
	(6.9e+01)	(7.6e+01)		(8.2e+01)		(8.6e+01)	
f_{19}	2.8e+03	1.3e+04	+	2.4e+03	·	1.7e+03	·
	(4.3e+03)	(5.5e+03)		(3.2e+03)		(1.7e+03)	
f_{20}	1.3e+01	1.4e+01	+	1.3e+01	·	1.3e+01	·
	(1.1e+00)	(2.3e−01)		(1.3e+00)		(1.2e+00)	
f_{21}	1.6e+03	2.4e+03	+	1.5e+03	·	1.6e+03	·
	(3.3e+02)	(1.5e+02)		(3.2e+02)		(3.3e+02)	
f_{22}	3.4e+03	5.9e+03	+	4.1e+03	+	3.3e+03	·
	(5.9e+02)	(3.9e+02)		(8.6e+02)		(6.4e+02)	
f_{23}	4.1e+03	7.9e+03	+	4.5e+03	·	4.1e+03	·
	(6.7e+02)	(2.8e+02)		(9.2e+02)		(1.4e+03)	
f_{24}	2.9e+02	3.2e+02	+	2.9e+02	·	2.8e+02	·
	(9.4e+00)	(4.6e+00)		(9.7e+00)		(9.8e+00)	
f_{25}	3.0e+02	3.4e+02	+	3.1e+02	·	3.0e+02	·
	(9.1e+00)	(3.8e+00)		(9.9e+00)		(7.5e+00)	
f_{26}	3.0e+02	2.3e+02	·	3.0e+02	·	3.0e+02	·
	(8.0e+01)	(5.3e+00)		(8.3e+01)		(7.9e+01)	
f_{27}	1.0e+03	1.4e+03	+	1.0e+03	·	9.7e+02	·
	(8.0e+01)	(2.7e+01)		(8.8e+01)		(6.1e+01)	
f_{28}	2.3e+03	3.2e+03	+	2.4e+03	·	2.2e+03	·
	(3.8e+02)	(2.2e+02)		(5.2e+02)		(5.0e+02)	
Summary (+/·/−)		25/3/0		3/24/1		0/26/2	

Table 107: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	2.7e+04	4.3e+03	−	0.0e+00	−	1.2e+04	−
	(2.5e+03)	(5.7e+02)		(0.0e+00)		(1.6e+03)	
f_2	2.0e+08	1.2e+08	−	1.5e+05	−	4.6e+07	−
	(3.5e+07)	(2.1e+07)		(5.8e+04)		(8.3e+06)	
f_3	3.2e+13	2.0e+10	−	2.2e+07	−	1.9e+10	−
	(8.5e+13)	(3.9e+09)		(9.6e+07)		(5.1e+09)	
f_4	4.1e+04	5.6e+04	+	1.3e+01	−	2.8e+04	−
	(3.6e+03)	(7.9e+03)		(7.8e+00)		(4.3e+03)	
f_5	6.1e+03	7.9e+02	−	5.0e−01	−	2.5e+03	−
	(9.6e+02)	(1.4e+02)		(1.2e+00)		(5.4e+02)	
f_6	3.7e+03	3.7e+02	−	4.1e+01	−	8.4e+02	−
	(5.3e+02)	(5.9e+01)		(2.5e+01)		(1.4e+02)	
f_7	1.4e+03	1.3e+02	−	5.0e+01	−	6.7e+01	−
	(9.7e+02)	(1.3e+01)		(2.7e+01)		(1.4e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.2e−02)	(4.6e−02)		(5.0e−02)		(5.2e−02)	
f_9	2.8e+01	3.8e+01	+	1.5e+01	−	1.4e+01	−
	(3.7e+00)	(1.1e+00)		(2.9e+00)		(1.4e+00)	
f_{10}	3.5e+03	8.6e+02	−	2.0e−01	−	1.3e+03	−
	(4.4e+02)	(1.5e+02)		(6.3e−01)		(1.5e+02)	
f_{11}	3.1e+02	2.3e+02	−	9.1e+01	−	1.3e+02	−
	(2.8e+01)	(1.8e+01)		(2.6e+01)		(1.7e+01)	
f_{12}	3.1e+02	2.9e+02	−	8.7e+01	−	1.3e+02	−
	(2.9e+01)	(1.9e+01)		(2.1e+01)		(1.9e+01)	
f_{13}	4.0e+02	2.9e+02	−	1.7e+02	−	2.1e+02	−
	(2.6e+01)	(1.6e+01)		(4.0e+01)		(2.9e+01)	
f_{14}	6.9e+03	5.1e+03	−	2.1e+03	−	6.6e+03	−
	(3.2e+02)	(3.1e+02)		(5.2e+02)		(2.2e+02)	
f_{15}	6.9e+03	7.2e+03	+	3.9e+03	−	6.3e+03	−
	(2.5e+02)	(2.7e+02)		(6.3e+02)		(2.7e+02)	
f_{16}	2.5e+00	2.5e+00	·	1.8e+00	−	2.4e+00	·
	(3.2e−01)	(3.0e−01)		(4.5e−01)		(3.2e−01)	
f_{17}	4.4e+02	4.2e+02	·	1.2e+02	−	2.2e+02	−
	(3.7e+01)	(3.4e+01)		(2.8e+01)		(1.7e+01)	
f_{18}	4.6e+02	4.3e+02	·	1.3e+02	−	2.3e+02	−
	(3.2e+01)	(3.9e+01)		(2.8e+01)		(1.4e+01)	
f_{19}	7.2e+04	3.3e+02	−	5.4e+00	−	1.1e+04	−
	(2.4e+04)	(1.4e+02)		(1.6e+00)		(3.9e+03)	
f_{20}	1.3e+01	1.3e+01	+	1.1e+01	−	1.1e+01	−
	(4.6e−01)	(2.2e−01)		(1.0e+00)		(3.5e−01)	
f_{21}	2.1e+03	1.3e+03	−	3.0e+02	−	1.9e+03	−
	(2.9e+01)	(1.7e+02)		(6.8e+01)		(4.7e+01)	
f_{22}	6.4e+03	5.5e+03	−	2.3e+03	−	2.2e+03	−
	(3.7e+02)	(4.4e+02)		(5.9e+02)		(1.7e+03)	
f_{23}	7.2e+03	7.3e+03	·	4.3e+03	−	5.7e+03	−
	(3.8e+02)	(2.5e+02)		(7.5e+02)		(3.9e+02)	
f_{24}	2.9e+02	3.0e+02	+	2.5e+02	−	2.6e+02	−
	(6.8e+00)	(4.1e+00)		(7.5e+00)		(6.5e+00)	
f_{25}	3.2e+02	3.2e+02	·	2.7e+02	−	2.9e+02	−
	(9.3e+00)	(3.0e+00)		(9.7e+00)		(7.9e+00)	
f_{26}	2.0e+02	2.1e+02	+	2.8e+02	·	2.6e+02	+
	(3.4e+00)	(2.0e+00)		(6.8e+01)		(5.5e+01)	
f_{27}	8.9e+02	1.3e+03	+	7.6e+02	−	6.9e+02	−
	(5.3e+01)	(2.6e+01)		(1.0e+02)		(3.0e+01)	
f_{28}	2.7e+03	2.1e+03	−	3.9e+02	−	2.3e+03	−
	(3.0e+02)	(1.1e+02)		(3.1e+02)		(1.6e+02)	
Summary (+/·/−)		7/6/15		0/2/26		1/2/25	

Table 108: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	7.7e+03	7.1e+03	·	1.4e+00	−	3.3e+01	−
	(1.9e+03)	(1.1e+03)		(6.0e+00)		(4.1e+01)	
f_2	5.7e+07	1.5e+08	+	1.1e+05	−	9.6e+04	−
	(2.0e+07)	(3.2e+07)		(4.5e+04)		(1.2e+05)	
f_3	2.4e+10	3.4e+10	+	1.8e+07	−	3.0e+07	−
	(1.0e+10)	(5.8e+09)		(6.2e+07)		(1.1e+08)	
f_4	5.0e+03	6.1e+04	+	3.0e+00	−	7.6e−02	−
	(2.5e+03)	(8.6e+03)		(6.7e+00)		(9.8e−02)	
f_5	1.4e+03	1.3e+03	·	4.6e+01	−	2.0e+02	−
	(4.8e+02)	(2.2e+02)		(4.2e+01)		(1.1e+02)	
f_6	6.5e+02	5.7e+02	·	7.2e+01	−	1.1e+02	−
	(2.1e+02)	(8.9e+01)		(3.2e+01)		(3.4e+01)	
f_7	9.6e+01	1.7e+02	+	6.9e+01	−	4.3e+01	−
	(2.5e+01)	(1.5e+01)		(2.7e+01)		(2.5e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.5e−02)	(4.3e−02)		(4.6e−02)		(4.1e−02)	
f_9	1.7e+01	3.9e+01	+	1.7e+01	·	1.3e+01	−
	(2.1e+00)	(9.2e−01)		(3.0e+00)		(2.4e+00)	
f_{10}	1.0e+03	1.3e+03	·	4.5e+01	−	9.2e+01	−
	(3.6e+02)	(1.7e+02)		(4.1e+01)		(7.8e+01)	
f_{11}	1.4e+02	2.7e+02	+	1.0e+02	−	6.6e+01	−
	(3.2e+01)	(2.0e+01)		(3.1e+01)		(1.9e+01)	
f_{12}	1.5e+02	3.4e+02	+	1.0e+02	−	7.8e+01	−
	(3.5e+01)	(2.2e+01)		(3.0e+01)		(3.7e+01)	
f_{13}	2.3e+02	3.3e+02	+	1.9e+02	−	1.5e+02	−
	(3.4e+01)	(2.5e+01)		(3.9e+01)		(4.2e+01)	
f_{14}	6.6e+03	5.2e+03	−	2.2e+03	−	6.4e+03	·
	(3.5e+02)	(3.2e+02)		(4.2e+02)		(4.6e+02)	
f_{15}	6.8e+03	7.2e+03	+	3.9e+03	−	7.0e+03	·
	(3.4e+02)	(3.1e+02)		(6.5e+02)		(4.3e+02)	
f_{16}	2.4e+00	2.5e+00	·	1.7e+00	−	2.5e+00	·
	(3.1e−01)	(3.1e−01)		(5.3e−01)		(2.2e−01)	
f_{17}	2.5e+02	5.5e+02	+	1.3e+02	−	2.0e+02	−
	(3.0e+01)	(4.4e+01)		(3.5e+01)		(1.6e+01)	
f_{18}	2.8e+02	5.4e+02	+	1.4e+02	−	2.1e+02	−
	(3.2e+01)	(5.3e+01)		(3.3e+01)		(1.7e+01)	
f_{19}	1.6e+03	1.3e+03	·	7.7e+00	−	1.1e+01	−
	(2.0e+03)	(6.1e+02)		(2.6e+00)		(5.1e+00)	
f_{20}	1.2e+01	1.4e+01	+	1.2e+01	·	1.2e+01	·
	(4.9e−01)	(2.4e−01)		(1.2e+00)		(7.0e−01)	
f_{21}	1.7e+03	1.7e+03	·	3.3e+02	−	4.4e+02	−
	(2.4e+02)	(1.7e+02)		(9.0e+01)		(1.2e+02)	
f_{22}	6.0e+03	5.7e+03	·	2.6e+03	−	5.2e+03	·
	(7.8e+02)	(4.3e+02)		(7.3e+02)		(1.9e+03)	
f_{23}	6.6e+03	7.5e+03	+	4.0e+03	−	7.0e+03	+
	(5.6e+02)	(2.5e+02)		(6.4e+02)		(4.8e+02)	
f_{24}	2.8e+02	3.1e+02	+	2.6e+02	−	2.5e+02	−
	(1.0e+01)	(3.9e+00)		(8.5e+00)		(1.1e+01)	
f_{25}	3.1e+02	3.3e+02	+	2.7e+02	−	2.7e+02	−
	(1.1e+01)	(3.1e+00)		(1.0e+01)		(7.0e+00)	
f_{26}	2.2e+02	2.2e+02	+	2.8e+02	·	2.6e+02	·
	(4.6e+01)	(3.1e+00)		(7.3e+01)		(6.8e+01)	
f_{27}	8.5e+02	1.3e+03	+	7.8e+02	·	6.9e+02	−
	(7.4e+01)	(3.8e+01)		(7.5e+01)		(8.9e+01)	
f_{28}	2.1e+03	2.5e+03	+	4.4e+02	−	5.4e+02	−
	(3.1e+02)	(1.4e+02)		(3.6e+02)		(2.0e+02)	
Summary (+/·/−)		18/9/1		0/5/23		1/7/20	

Table 109: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.6e−01	8.7e−02	+	0.0e+00	·	0.0e+00	·
	(1.1e+00)	(5.3e−01)		(0.0e+00)		(0.0e+00)	
f_2	1.5e+06	7.3e+06	+	3.9e+05	−	1.8e+05	−
	(7.8e+05)	(3.6e+06)		(1.8e+05)		(1.5e+05)	
f_3	2.0e+07	7.2e+08	+	1.1e+07	−	7.0e+05	−
	(2.9e+07)	(7.1e+08)		(3.3e+07)		(1.2e+06)	
f_4	5.5e+03	1.2e+04	+	1.7e+03	−	1.2e+03	−
	(1.6e+03)	(2.9e+03)		(6.0e+02)		(7.7e+02)	
f_5	6.7e+00	5.8e+01	+	0.0e+00	−	1.1e+00	−
	(2.1e+01)	(9.2e+01)		(0.0e+00)		(3.7e+00)	
f_6	3.7e+01	6.1e+01	+	1.1e+01	−	2.8e+01	−
	(1.9e+01)	(2.0e+01)		(1.0e+01)		(1.9e+01)	
f_7	1.5e+00	1.9e+01	+	2.4e+01	+	1.3e−02	−
	(1.6e+00)	(9.1e+00)		(1.6e+01)		(4.7e−02)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.8e−02)	(4.0e−02)		(4.9e−02)		(5.3e−02)	
f_9	9.5e+00	1.1e+01	+	1.2e+01	+	3.5e+01	+
	(8.6e+00)	(1.9e+00)		(3.4e+00)		(5.7e+00)	
f_{10}	2.5e+00	1.9e+01	+	1.6e−02	−	1.7e−02	−
	(2.1e+00)	(1.5e+01)		(1.6e−02)		(3.0e−02)	
f_{11}	1.2e+02	2.0e+01	−	6.9e+01	−	1.4e+02	+
	(9.2e+00)	(1.2e+01)		(1.9e+01)		(8.1e+00)	
f_{12}	1.5e+02	2.2e+01	−	6.8e+01	−	1.6e+02	·
	(7.9e+00)	(5.5e+00)		(1.8e+01)		(8.1e+00)	
f_{13}	1.5e+02	4.7e+01	−	1.3e+02	−	1.6e+02	·
	(1.1e+01)	(1.7e+01)		(2.9e+01)		(1.1e+01)	
f_{14}	6.4e+03	4.2e+03	−	1.9e+03	−	6.8e+03	+
	(2.8e+02)	(4.6e+02)		(5.1e+02)		(2.3e+02)	
f_{15}	6.9e+03	7.0e+03	·	4.4e+03	−	6.9e+03	·
	(2.4e+02)	(2.9e+02)		(7.5e+02)		(3.2e+02)	
f_{16}	2.4e+00	2.4e+00	·	2.0e+00	−	2.5e+00	·
	(2.6e−01)	(2.9e−01)		(4.3e−01)		(2.6e−01)	
f_{17}	1.7e+02	1.2e+02	−	1.1e+02	−	1.7e+02	·
	(9.5e+00)	(1.0e+01)		(2.3e+01)		(9.4e+00)	
f_{18}	1.8e+02	1.9e+02	·	1.4e+02	−	1.8e+02	·
	(7.6e+00)	(6.8e+00)		(3.0e+01)		(9.9e+00)	
f_{19}	1.1e+01	5.5e+00	−	4.5e+00	−	1.3e+01	+
	(1.6e+00)	(2.1e+00)		(1.4e+00)		(8.3e−01)	
f_{20}	1.1e+01	1.2e+01	·	1.2e+01	·	1.2e+01	·
	(3.2e−01)	(3.4e−01)		(9.8e−01)		(2.7e−01)	
f_{21}	3.1e+02	3.2e+02	+	3.0e+02	·	3.2e+02	·
	(8.2e+01)	(9.2e+01)		(8.2e+01)		(7.3e+01)	
f_{22}	6.2e+03	3.7e+03	−	2.0e+03	−	6.4e+03	+
	(3.4e+02)	(7.4e+02)		(5.2e+02)		(2.7e+02)	
f_{23}	6.7e+03	6.7e+03	·	4.5e+03	−	6.9e+03	·
	(2.6e+02)	(5.0e+02)		(8.4e+02)		(2.4e+02)	
f_{24}	2.0e+02	2.2e+02	+	2.4e+02	+	2.0e+02	−
	(1.9e+00)	(6.9e+00)		(8.9e+00)		(1.9e−02)	
f_{25}	2.4e+02	2.5e+02	+	2.6e+02	+	2.1e+02	−
	(1.3e+01)	(5.8e+00)		(8.2e+00)		(1.4e+01)	
f_{26}	2.0e+02	2.0e+02	+	2.6e+02	+	2.1e+02	−
	(1.9e−02)	(1.9e+01)		(6.6e+01)		(3.5e+01)	
f_{27}	3.2e+02	5.8e+02	+	6.7e+02	+	3.0e+02	−
	(3.4e+01)	(9.5e+01)		(7.8e+01)		(9.3e−01)	
f_{28}	3.1e+02	4.3e+02	+	3.4e+02	·	3.0e+02	·
	(2.4e+01)	(1.3e+02)		(2.1e+02)		(3.6e−01)	
Summary (+/·/−)		15/6/7		6/5/17		5/12/11	

Table 110: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.5e+04	2.1e+03	−	0.0e+00	−	0.0e+00	−
	(2.9e+03)	(4.9e+02)		(0.0e+00)		(0.0e+00)	
f_2	9.8e+07	7.6e+07	·	1.7e+05	−	9.0e+04	−
	(4.1e+07)	(1.5e+07)		(7.3e+04)		(5.4e+04)	
f_3	8.5e+10	9.4e+09	−	3.5e+06	−	4.4e+05	−
	(1.1e+11)	(2.3e+09)		(6.5e+06)		(1.7e+06)	
f_4	1.4e+04	4.7e+04	+	6.8e+01	−	3.2e+01	−
	(4.0e+03)	(6.6e+03)		(4.8e+01)		(1.4e+01)	
f_5	2.7e+03	4.2e+02	−	0.0e+00	−	0.0e+00	−
	(8.7e+02)	(9.9e+01)		(0.0e+00)		(0.0e+00)	
f_6	1.4e+03	2.3e+02	−	1.9e+01	−	2.3e+01	−
	(4.6e+02)	(2.9e+01)		(1.6e+01)		(1.7e+01)	
f_7	1.3e+02	8.9e+01	−	4.3e+01	−	2.8e+01	−
	(4.8e+01)	(1.0e+01)		(2.4e+01)		(2.2e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.7e−02)	(5.2e−02)		(5.9e−02)		(5.0e−02)	
f_9	1.5e+01	3.5e+01	+	1.4e+01	·	8.6e+00	−
	(1.9e+00)	(1.8e+00)		(3.3e+00)		(2.3e+00)	
f_{10}	1.8e+03	5.0e+02	−	2.3e−02	−	1.8e−02	−
	(4.7e+02)	(9.6e+01)		(1.6e−02)		(1.4e−02)	
f_{11}	1.9e+02	1.9e+02	·	7.6e+01	−	1.7e+02	·
	(3.6e+01)	(1.8e+01)		(2.5e+01)		(1.3e+01)	
f_{12}	1.8e+02	2.5e+02	+	9.0e+01	−	1.9e+02	·
	(3.1e+01)	(1.5e+01)		(3.0e+01)		(1.5e+01)	
f_{13}	2.6e+02	2.5e+02	·	1.6e+02	−	1.9e+02	−
	(3.6e+01)	(1.6e+01)		(3.8e+01)		(1.9e+01)	
f_{14}	6.6e+03	5.0e+03	−	2.0e+03	−	6.7e+03	·
	(3.0e+02)	(3.0e+02)		(5.1e+02)		(3.0e+02)	
f_{15}	6.5e+03	7.0e+03	+	4.1e+03	−	7.3e+03	+
	(3.6e+02)	(3.0e+02)		(7.8e+02)		(2.9e+02)	
f_{16}	2.5e+00	2.5e+00	·	1.9e+00	−	2.5e+00	·
	(2.7e−01)	(2.8e−01)		(5.0e−01)		(3.1e−01)	
f_{17}	2.9e+02	3.2e+02	·	1.1e+02	−	2.0e+02	−
	(3.5e+01)	(3.1e+01)		(3.2e+01)		(1.5e+01)	
f_{18}	3.2e+02	3.4e+02	·	1.3e+02	−	2.1e+02	−
	(4.3e+01)	(2.8e+01)		(2.6e+01)		(1.5e+01)	
f_{19}	7.7e+03	6.4e+01	−	4.6e+00	−	1.4e+01	−
	(7.0e+03)	(2.2e+01)		(1.4e+00)		(1.1e+00)	
f_{20}	1.1e+01	1.3e+01	+	1.2e+01	·	1.2e+01	+
	(3.7e−01)	(2.0e−01)		(6.7e−01)		(4.1e−01)	
f_{21}	1.9e+03	9.5e+02	−	3.0e+02	−	3.2e+02	−
	(1.5e+02)	(1.6e+02)		(7.5e+01)		(8.7e+01)	
f_{22}	5.5e+03	5.3e+03	·	2.1e+03	−	6.7e+03	+
	(5.3e+02)	(3.8e+02)		(4.3e+02)		(3.9e+02)	
f_{23}	6.2e+03	7.2e+03	+	4.1e+03	−	7.2e+03	+
	(4.4e+02)	(3.3e+02)		(8.4e+02)		(4.2e+02)	
f_{24}	2.9e+02	2.8e+02	−	2.5e+02	−	2.3e+02	−
	(9.7e+00)	(6.4e+00)		(8.4e+00)		(1.4e+01)	
f_{25}	3.2e+02	3.1e+02	−	2.6e+02	−	2.6e+02	−
	(8.0e+00)	(4.2e+00)		(8.3e+00)		(7.5e+00)	
f_{26}	2.3e+02	2.1e+02	·	2.9e+02	·	2.8e+02	·
	(5.3e+01)	(2.3e+01)		(6.5e+01)		(6.0e+01)	
f_{27}	8.6e+02	1.1e+03	+	7.1e+02	−	5.9e+02	−
	(5.7e+01)	(6.8e+01)		(7.4e+01)		(7.8e+01)	
f_{28}	2.6e+03	1.7e+03	−	3.4e+02	−	3.3e+02	−
	(2.7e+02)	(1.2e+02)		(2.2e+02)		(2.1e+02)	
Summary (+/·/−)		7/9/12		0/4/24		4/6/18	

Table 111: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	4.9e−07	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(9.5e−08)		(0.0e+00)	
f_2	4.0e+07	4.1e+07	·	3.6e+07	·	3.8e+07	·
	(6.4e+06)	(8.3e+06)		(8.5e+06)		(7.0e+06)	
f_3	4.3e+09	4.0e+09	·	3.9e+09	·	4.7e+09	·
	(7.4e+08)	(8.3e+08)		(8.6e+08)		(9.2e+08)	
f_4	6.6e+04	7.0e+04	·	5.8e+04	−	6.5e+04	·
	(1.0e+04)	(9.1e+03)		(8.6e+03)		(7.9e+03)	
f_5	3.9e−07	4.0e−07	·	5.6e−05	+	9.4e−07	+
	(4.6e−08)	(4.6e−08)		(1.1e−05)		(1.3e−07)	
f_6	5.3e+01	5.3e+01	·	4.1e+01	−	5.7e+01	·
	(3.9e+00)	(3.8e+00)		(7.4e+00)		(5.4e+00)	
f_7	9.6e+01	9.6e+01	·	8.4e+01	−	9.2e+01	·
	(1.1e+01)	(8.5e+00)		(1.0e+01)		(9.4e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.5e−02)	(4.9e−02)		(5.0e−02)		(6.5e−02)	
f_9	3.1e+01	3.2e+01	·	3.1e+01	·	3.1e+01	·
	(1.4e+00)	(9.8e−01)		(1.5e+00)		(1.4e+00)	
f_{10}	8.8e+01	8.9e+01	·	1.0e+02	·	8.2e+01	·
	(1.7e+01)	(1.4e+01)		(1.9e+01)		(1.3e+01)	
f_{11}	2.9e−02	2.6e−02	·	2.0e−03	−	2.3e+01	+
	(9.3e−03)	(1.0e−02)		(7.2e−04)		(1.7e+00)	
f_{12}	2.0e+02	1.9e+02	·	2.0e+02	·	2.0e+02	·
	(1.4e+01)	(1.3e+01)		(1.4e+01)		(1.1e+01)	
f_{13}	2.1e+02	2.1e+02	·	2.2e+02	+	2.1e+02	·
	(9.6e+00)	(1.5e+01)		(1.4e+01)		(1.3e+01)	
f_{14}	2.9e+02	2.9e+02	·	2.3e+02	−	1.2e+03	+
	(4.1e+01)	(3.7e+01)		(5.4e+01)		(9.9e+01)	
f_{15}	6.5e+03	6.6e+03	·	6.4e+03	·	6.5e+03	·
	(3.0e+02)	(3.1e+02)		(3.0e+02)		(3.4e+02)	
f_{16}	2.4e+00	2.3e+00	·	2.4e+00	·	2.4e+00	·
	(2.3e−01)	(2.7e−01)		(2.3e−01)		(2.3e−01)	
f_{17}	3.7e+01	3.7e+01	·	5.2e+01	+	5.5e+01	+
	(6.1e−01)	(6.2e−01)		(2.3e+00)		(2.0e+00)	
f_{18}	2.5e+02	2.4e+02	·	2.6e+02	+	2.4e+02	·
	(9.5e+00)	(1.7e+01)		(1.1e+01)		(1.1e+01)	
f_{19}	4.9e+00	4.9e+00	·	5.9e+00	+	4.9e+00	·
	(4.0e−01)	(4.1e−01)		(4.6e−01)		(3.9e−01)	
f_{20}	1.4e+01	1.4e+01	·	1.3e+01	−	1.4e+01	·
	(2.5e−01)	(2.6e−01)		(2.9e−01)		(2.7e−01)	
f_{21}	3.3e+02	3.3e+02	·	3.2e+02	−	5.3e+02	+
	(2.1e+01)	(2.1e+01)		(7.9e+01)		(2.2e+01)	
f_{22}	1.3e+03	1.2e+03	·	8.4e+02	−	1.5e+03	+
	(1.3e+02)	(1.4e+02)		(1.5e+02)		(1.3e+02)	
f_{23}	7.1e+03	7.0e+03	·	6.9e+03	−	7.0e+03	·
	(2.4e+02)	(3.7e+02)		(3.2e+02)		(3.1e+02)	
f_{24}	2.8e+02	2.8e+02	·	2.8e+02	·	2.8e+02	·
	(4.4e+00)	(4.2e+00)		(4.8e+00)		(3.6e+00)	
f_{25}	2.9e+02	3.0e+02	·	2.9e+02	·	3.0e+02	·
	(3.7e+00)	(3.4e+00)		(3.9e+00)		(4.0e+00)	
f_{26}	2.0e+02	2.0e+02	·	2.0e+02	−	2.0e+02	−
	(7.1e−01)	(9.2e−01)		(7.5e−01)		(7.8e−01)	
f_{27}	1.0e+03	1.0e+03	·	1.1e+03	·	1.0e+03	·
	(9.8e+01)	(1.1e+02)		(1.2e+02)		(9.7e+01)	
f_{28}	3.0e+02	3.0e+02	·	3.0e+02	+	5.1e+02	+
	(1.1e−01)	(2.4e−01)		(1.6e−01)		(5.3e+01)	
Summary (+/·/−)		0/28/0		7/11/10		7/20/1	

Table 112: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	2.3e−06	2.0e−06	−	1.0e−04	+	3.7e−06	+
	(4.0e−07)	(3.4e−07)		(2.1e−05)		(5.5e−07)	
f_2	4.2e+07	4.2e+07	·	3.8e+07	·	4.0e+07	·
	(7.3e+06)	(6.8e+06)		(7.6e+06)		(7.7e+06)	
f_3	5.8e+09	6.1e+09	·	5.1e+09	·	6.3e+09	·
	(1.2e+09)	(1.1e+09)		(9.7e+08)		(1.4e+09)	
f_4	6.7e+04	6.8e+04	·	6.1e+04	−	6.9e+04	·
	(8.1e+03)	(8.0e+03)		(8.1e+03)		(7.6e+03)	
f_5	1.4e−04	1.3e−04	·	2.2e−03	+	1.9e−04	+
	(1.6e−05)	(1.8e−05)		(3.8e−04)		(2.5e−05)	
f_6	5.9e+01	5.9e+01	·	5.1e+01	−	6.4e+01	+
	(6.0e+00)	(5.9e+00)		(8.5e+00)		(4.9e+00)	
f_7	1.0e+02	1.0e+02	·	9.2e+01	·	1.0e+02	·
	(9.6e+00)	(9.2e+00)		(1.1e+01)		(8.3e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.9e−02)	(4.0e−02)		(4.6e−02)		(5.4e−02)	
f_9	3.2e+01	3.1e+01	·	3.1e+01	·	3.1e+01	·
	(1.4e+00)	(1.2e+00)		(1.8e+00)		(1.3e+00)	
f_{10}	1.4e+02	1.3e+02	·	1.3e+02	·	1.2e+02	·
	(2.0e+01)	(2.0e+01)		(2.4e+01)		(1.8e+01)	
f_{11}	1.6e+01	1.6e+01	·	2.2e−03	−	2.9e+01	+
	(1.7e+00)	(1.7e+00)		(5.8e−04)		(2.6e+00)	
f_{12}	2.1e+02	2.1e+02	·	2.1e+02	·	2.0e+02	·
	(1.2e+01)	(1.1e+01)		(1.5e+01)		(1.3e+01)	
f_{13}	2.2e+02	2.2e+02	·	2.3e+02	·	2.2e+02	·
	(1.1e+01)	(1.6e+01)		(1.4e+01)		(1.0e+01)	
f_{14}	1.0e+03	5.4e+02	−	4.2e+01	−	1.2e+03	+
	(1.2e+02)	(7.6e+01)		(7.8e+00)		(1.2e+02)	
f_{15}	6.6e+03	6.5e+03	·	6.4e+03	·	6.6e+03	·
	(2.3e+02)	(3.2e+02)		(3.4e+02)		(2.7e+02)	
f_{16}	2.4e+00	2.4e+00	·	2.3e+00	·	2.4e+00	·
	(2.6e−01)	(2.8e−01)		(3.1e−01)		(2.8e−01)	
f_{17}	5.0e+01	6.0e+01	+	3.1e+01	−	6.3e+01	+
	(1.7e+00)	(2.3e+00)		(2.7e−01)		(2.6e+00)	
f_{18}	2.6e+02	2.6e+02	·	2.8e+02	+	2.6e+02	·
	(1.2e+01)	(1.2e+01)		(1.4e+01)		(1.3e+01)	
f_{19}	5.9e+00	6.0e+00	·	6.7e+00	+	5.9e+00	·
	(4.6e−01)	(4.8e−01)		(5.8e−01)		(4.1e−01)	
f_{20}	1.4e+01	1.4e+01	·	1.3e+01	−	1.4e+01	·
	(2.3e−01)	(3.0e−01)		(3.1e−01)		(3.1e−01)	
f_{21}	4.9e+02	4.1e+02	−	3.5e+02	−	5.6e+02	+
	(3.0e+01)	(2.7e+01)		(8.9e+01)		(2.4e+01)	
f_{22}	1.6e+03	1.4e+03	−	6.0e+02	−	1.6e+03	·
	(1.3e+02)	(1.4e+02)		(1.2e+02)		(1.5e+02)	
f_{23}	7.0e+03	7.1e+03	·	7.0e+03	·	7.1e+03	·
	(3.5e+02)	(3.7e+02)		(4.1e+02)		(3.1e+02)	
f_{24}	2.8e+02	2.8e+02	·	2.8e+02	·	2.8e+02	·
	(4.2e+00)	(4.5e+00)		(3.6e+00)		(3.8e+00)	
f_{25}	3.0e+02	3.0e+02	·	3.0e+02	·	3.0e+02	·
	(2.8e+00)	(3.2e+00)		(3.5e+00)		(3.1e+00)	
f_{26}	2.0e+02	2.0e+02	·	2.0e+02	−	2.0e+02	·
	(8.6e−01)	(9.3e−01)		(6.3e−01)		(8.8e−01)	
f_{27}	9.9e+02	9.8e+02	·	9.6e+02	·	1.0e+03	·
	(1.2e+02)	(1.1e+02)		(1.9e+02)		(1.3e+02)	
f_{28}	3.2e+02	3.1e+02	−	3.1e+02	−	6.5e+02	+
	(1.2e+01)	(4.9e+00)		(2.2e+00)		(5.7e+01)	
Summary (+/·/−)		1/22/5		4/14/10		8/20/0	

Table 113: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	2.6e+02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(3.6e+01)		(0.0e+00)		(0.0e+00)	
f_2	2.8e+07	4.1e+07	+	2.8e+07	·	2.7e+07	·
	(6.7e+06)	(8.1e+06)		(7.8e+06)		(6.8e+06)	
f_3	7.4e+08	7.0e+09	+	7.3e+08	·	1.1e+09	+
	(2.4e+08)	(1.3e+09)		(2.3e+08)		(3.5e+08)	
f_4	5.2e+04	6.8e+04	+	5.2e+04	·	5.3e+04	·
	(8.6e+03)	(8.8e+03)		(6.7e+03)		(8.2e+03)	
f_5	0.0e+00	4.8e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(5.4e+00)		(0.0e+00)		(0.0e+00)	
f_6	3.1e+01	9.4e+01	+	3.3e+01	·	3.5e+01	·
	(1.1e+01)	(1.0e+01)		(1.1e+01)		(1.4e+01)	
f_7	6.4e+01	9.9e+01	+	6.6e+01	·	6.3e+01	·
	(9.8e+00)	(1.1e+01)		(8.5e+00)		(9.3e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.2e−02)	(5.0e−02)		(4.5e−02)		(5.6e−02)	
f_9	3.0e+01	3.2e+01	+	3.0e+01	·	3.1e+01	·
	(1.8e+00)	(1.0e+00)		(1.7e+00)		(1.5e+00)	
f_{10}	1.7e+01	1.7e+02	+	1.7e+01	·	2.7e+01	+
	(4.6e+00)	(2.3e+01)		(5.1e+00)		(6.1e+00)	
f_{11}	0.0e+00	5.2e+01	+	0.0e+00	·	1.7e+01	+
	(0.0e+00)	(4.7e+00)		(0.0e+00)		(2.4e+00)	
f_{12}	1.5e+02	2.2e+02	+	1.5e+02	·	1.6e+02	+
	(1.6e+01)	(1.5e+01)		(1.4e+01)		(1.3e+01)	
f_{13}	1.7e+02	2.3e+02	+	1.7e+02	·	1.7e+02	·
	(1.6e+01)	(1.4e+01)		(1.4e+01)		(1.5e+01)	
f_{14}	1.2e+01	1.0e+03	+	8.6e+00	·	9.7e+02	+
	(2.2e+01)	(1.2e+02)		(7.1e+00)		(1.2e+02)	
f_{15}	6.2e+03	6.5e+03	·	6.3e+03	·	6.3e+03	·
	(3.7e+02)	(3.3e+02)		(3.6e+02)		(3.8e+02)	
f_{16}	2.3e+00	2.4e+00	·	2.4e+00	·	2.3e+00	·
	(2.6e−01)	(2.9e−01)		(2.7e−01)		(2.7e−01)	
f_{17}	3.1e+01	1.3e+02	+	3.0e+01	·	5.1e+01	+
	(8.7e−02)	(8.2e+00)		(4.0e+00)		(1.6e+00)	
f_{18}	2.2e+02	3.1e+02	+	2.2e+02	·	2.2e+02	·
	(1.4e+01)	(1.6e+01)		(1.1e+01)		(1.1e+01)	
f_{19}	3.9e+00	1.5e+01	+	3.9e+00	·	4.1e+00	·
	(4.0e−01)	(1.1e+00)		(3.7e−01)		(3.2e−01)	
f_{20}	1.3e+01	1.4e+01	+	1.3e+01	·	1.3e+01	·
	(2.8e−01)	(2.8e−01)		(2.9e−01)		(2.8e−01)	
f_{21}	3.0e+02	6.5e+02	+	3.0e+02	·	3.3e+02	+
	(7.0e+01)	(3.5e+01)		(7.7e+01)		(7.2e+01)	
f_{22}	3.7e+02	1.5e+03	+	3.8e+02	·	1.2e+03	+
	(1.6e+02)	(1.2e+02)		(1.7e+02)		(1.4e+02)	
f_{23}	6.7e+03	7.1e+03	+	6.7e+03	·	6.7e+03	·
	(3.6e+02)	(3.0e+02)		(4.7e+02)		(3.0e+02)	
f_{24}	2.7e+02	2.8e+02	+	2.7e+02	+	2.7e+02	·
	(6.2e+00)	(4.5e+00)		(6.3e+00)		(7.2e+00)	
f_{25}	2.9e+02	3.0e+02	+	2.9e+02	·	2.9e+02	·
	(4.7e+00)	(3.5e+00)		(5.5e+00)		(4.7e+00)	
f_{26}	2.0e+02	2.0e+02	+	2.0e+02	·	2.0e+02	·
	(4.7e−01)	(9.3e−01)		(4.8e−01)		(6.4e−01)	
f_{27}	1.1e+03	1.0e+03	·	1.1e+03	·	1.1e+03	·
	(4.7e+01)	(1.2e+02)		(4.6e+01)		(5.9e+01)	
f_{28}	3.5e+02	1.1e+03	+	3.2e+02	·	3.4e+02	+
	(2.3e+02)	(7.0e+01)		(1.6e+02)		(1.7e+02)	
Summary (+/·/−)		24/4/0		1/27/0		9/19/0	

Table 114: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	2.9e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(9.8e+00)		(0.0e+00)		(0.0e+00)	
f_2	3.1e+07	3.8e+07	·	3.1e+07	·	3.3e+07	·
	(8.3e+06)	(7.4e+06)		(6.8e+06)		(7.4e+06)	
f_3	2.5e+09	9.4e+08	−	2.4e+09	·	2.7e+09	·
	(6.3e+08)	(3.4e+08)		(4.6e+08)		(5.7e+08)	
f_4	5.8e+04	6.8e+04	+	5.7e+04	·	5.4e+04	·
	(7.2e+03)	(1.1e+04)		(8.3e+03)		(7.3e+03)	
f_5	1.5e−07	1.0e+01	+	9.9e−08	−	2.6e−07	+
	(2.9e−08)	(4.4e+00)		(2.1e−08)		(5.1e−08)	
f_6	3.6e+01	6.0e+01	+	3.3e+01	·	3.6e+01	·
	(8.2e+00)	(6.1e+00)		(8.0e+00)		(8.2e+00)	
f_7	7.5e+01	9.0e+01	+	7.5e+01	·	7.7e+01	·
	(8.7e+00)	(8.1e+00)		(9.5e+00)		(7.9e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.5e−02)	(5.9e−02)		(6.4e−02)		(4.8e−02)	
f_9	3.1e+01	3.1e+01	·	3.1e+01	·	3.1e+01	·
	(1.7e+00)	(1.6e+00)		(1.3e+00)		(1.5e+00)	
f_{10}	6.3e+01	2.7e+01	−	5.9e+01	·	6.9e+01	·
	(1.1e+01)	(7.3e+00)		(1.0e+01)		(1.3e+01)	
f_{11}	2.7e+00	1.5e+01	+	4.0e−02	−	2.6e+01	+
	(1.1e+00)	(2.5e+00)		(1.9e−01)		(2.2e+00)	
f_{12}	1.8e+02	1.7e+02	−	1.9e+02	·	1.8e+02	·
	(1.7e+01)	(1.1e+01)		(1.4e+01)		(1.2e+01)	
f_{13}	2.0e+02	1.8e+02	−	2.0e+02	·	2.0e+02	·
	(1.3e+01)	(1.4e+01)		(1.6e+01)		(1.4e+01)	
f_{14}	7.8e+02	7.6e+01	−	1.4e+02	−	1.1e+03	+
	(1.2e+02)	(2.4e+01)		(5.8e+01)		(1.2e+02)	
f_{15}	6.4e+03	6.5e+03	·	6.4e+03	·	6.2e+03	·
	(3.3e+02)	(3.1e+02)		(4.0e+02)		(3.9e+02)	
f_{16}	2.2e+00	2.4e+00	·	2.3e+00	·	2.3e+00	·
	(2.7e−01)	(2.2e−01)		(2.8e−01)		(3.0e−01)	
f_{17}	4.0e+01	6.0e+01	+	4.7e+01	+	5.8e+01	+
	(1.0e+00)	(5.8e+00)		(2.1e+00)		(2.5e+00)	
f_{18}	2.4e+02	2.2e+02	−	2.4e+02	·	2.4e+02	·
	(1.1e+01)	(9.7e+00)		(1.4e+01)		(1.2e+01)	
f_{19}	5.1e+00	2.8e+00	−	5.1e+00	·	4.9e+00	·
	(3.8e−01)	(5.2e−01)		(4.3e−01)		(4.1e−01)	
f_{20}	1.3e+01	1.4e+01	+	1.3e+01	·	1.3e+01	·
	(2.8e−01)	(2.3e−01)		(3.3e−01)		(2.4e−01)	
f_{21}	3.0e+02	4.4e+02	+	2.9e+02	·	3.7e+02	+
	(8.2e+01)	(3.3e+01)		(8.5e+01)		(5.8e+01)	
f_{22}	1.3e+03	2.0e+02	−	6.8e+02	−	1.3e+03	·
	(1.7e+02)	(2.4e+01)		(1.9e+02)		(1.7e+02)	
f_{23}	6.7e+03	7.1e+03	+	6.8e+03	·	6.9e+03	·
	(3.2e+02)	(3.1e+02)		(3.6e+02)		(3.1e+02)	
f_{24}	2.8e+02	2.8e+02	·	2.8e+02	·	2.8e+02	·
	(4.7e+00)	(4.2e+00)		(5.9e+00)		(4.9e+00)	
f_{25}	2.9e+02	2.9e+02	·	2.9e+02	·	2.9e+02	·
	(4.5e+00)	(3.5e+00)		(4.5e+00)		(3.8e+00)	
f_{26}	2.0e+02	2.0e+02	+	2.0e+02	·	2.0e+02	·
	(6.3e−01)	(8.7e−01)		(7.0e−01)		(5.7e−01)	
f_{27}	1.0e+03	1.0e+03	·	1.1e+03	·	1.1e+03	·
	(1.3e+02)	(8.2e+01)		(6.3e+01)		(8.9e+01)	
f_{28}	3.0e+02	5.6e+02	+	3.0e+02	−	3.4e+02	+
	(6.9e−03)	(5.5e+01)		(4.3e−03)		(3.5e+01)	
Summary (+/·/−)		12/8/8		1/22/5		6/22/0	

Table 115: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	2.9e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.4e+01)		(0.0e+00)		(0.0e+00)	
f_2	2.5e+07	3.9e+07	+	3.1e+07	+	3.1e+07	+
	(5.3e+06)	(6.4e+06)		(6.9e+06)		(5.7e+06)	
f_3	2.3e+09	9.5e+08	−	2.5e+09	·	2.7e+09	+
	(4.1e+08)	(2.9e+08)		(6.4e+08)		(5.9e+08)	
f_4	6.2e+04	6.8e+04	·	5.6e+04	·	6.0e+04	·
	(6.6e+03)	(9.6e+03)		(8.6e+03)		(7.8e+03)	
f_5	5.0e−09	1.2e+01	+	9.8e−08	+	0.0e+00	·
	(5.8e−09)	(9.8e+00)		(2.2e−08)		(0.0e+00)	
f_6	3.9e+01	6.0e+01	+	3.2e+01	−	5.0e+01	+
	(5.3e+00)	(6.4e+00)		(7.9e+00)		(5.4e+00)	
f_7	8.3e+01	9.2e+01	+	7.5e+01	−	8.4e+01	·
	(8.7e+00)	(8.8e+00)		(7.4e+00)		(8.6e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.5e−02)	(5.4e−02)		(5.9e−02)		(5.4e−02)	
f_9	3.0e+01	3.1e+01	+	3.1e+01	·	3.2e+01	+
	(1.1e+00)	(1.3e+00)		(1.4e+00)		(9.2e−01)	
f_{10}	7.8e+00	2.8e+01	+	5.7e+01	+	3.1e+01	+
	(1.1e+00)	(7.5e+00)		(1.1e+01)		(4.9e+00)	
f_{11}	5.2e−01	1.5e+01	+	7.6e−04	−	1.6e+01	+
	(1.3e−01)	(3.2e+00)		(1.5e−03)		(1.5e+00)	
f_{12}	1.8e+02	1.7e+02	−	1.8e+02	·	1.6e+02	−
	(1.3e+01)	(1.1e+01)		(1.4e+01)		(1.5e+01)	
f_{13}	2.0e+02	1.8e+02	−	2.0e+02	·	1.9e+02	−
	(1.5e+01)	(1.3e+01)		(1.1e+01)		(1.3e+01)	
f_{14}	1.1e+03	7.6e+01	−	1.3e+02	−	1.0e+03	·
	(1.4e+02)	(2.3e+01)		(5.0e+01)		(1.0e+02)	
f_{15}	6.3e+03	6.6e+03	+	6.4e+03	·	6.4e+03	·
	(2.4e+02)	(2.5e+02)		(3.3e+02)		(3.3e+02)	
f_{16}	2.3e+00	2.4e+00	·	2.3e+00	·	2.4e+00	·
	(2.5e−01)	(2.7e−01)		(2.9e−01)		(2.6e−01)	
f_{17}	3.3e+01	6.1e+01	+	4.7e+01	+	4.8e+01	+
	(2.9e−01)	(5.0e+00)		(2.7e+00)		(1.5e+00)	
f_{18}	2.3e+02	2.2e+02	·	2.5e+02	+	2.2e+02	−
	(1.1e+01)	(1.3e+01)		(1.1e+01)		(1.1e+01)	
f_{19}	3.1e+00	2.7e+00	·	5.0e+00	+	3.8e+00	+
	(3.7e−01)	(5.3e−01)		(3.6e−01)		(2.9e−01)	
f_{20}	1.4e+01	1.4e+01	·	1.3e+01	−	1.4e+01	·
	(3.9e−01)	(2.9e−01)		(2.1e−01)		(3.1e−01)	
f_{21}	3.0e+02	4.3e+02	+	2.9e+02	−	4.4e+02	+
	(6.1e+00)	(2.5e+01)		(7.9e+01)		(2.8e+01)	
f_{22}	1.4e+03	2.1e+02	−	6.7e+02	−	1.4e+03	·
	(1.1e+02)	(3.0e+01)		(1.8e+02)		(1.3e+02)	
f_{23}	6.9e+03	7.1e+03	·	6.7e+03	·	7.0e+03	·
	(2.7e+02)	(3.4e+02)		(4.2e+02)		(2.9e+02)	
f_{24}	2.7e+02	2.8e+02	+	2.8e+02	+	2.7e+02	·
	(3.5e+00)	(4.3e+00)		(5.5e+00)		(3.9e+00)	
f_{25}	3.0e+02	2.9e+02	−	2.9e+02	−	3.0e+02	·
	(3.5e+00)	(3.6e+00)		(4.3e+00)		(3.3e+00)	
f_{26}	2.0e+02	2.0e+02	+	2.0e+02	·	2.0e+02	+
	(4.3e−01)	(8.2e−01)		(6.3e−01)		(6.5e−01)	
f_{27}	7.7e+02	1.1e+03	+	1.0e+03	+	1.1e+03	+
	(1.5e+02)	(1.0e+02)		(1.3e+02)		(5.3e+01)	
f_{28}	3.0e+02	5.7e+02	+	3.0e+02	−	4.1e+02	+
	(3.3e−01)	(6.0e+01)		(2.1e−03)		(3.7e+01)	
Summary (+/·/−)		15/7/6		8/11/9		12/13/3	

Table 116: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	8.3e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.1e+01)		(0.0e+00)		(0.0e+00)	
f_2	1.8e+07	3.6e+07	+	2.9e+07	+	2.8e+07	+
	(5.2e+06)	(8.6e+06)		(6.8e+06)		(6.2e+06)	
f_3	4.3e+08	3.7e+09	+	1.4e+09	+	1.4e+09	+
	(1.3e+08)	(8.6e+08)		(4.2e+08)		(3.9e+08)	
f_4	5.2e+04	6.8e+04	+	5.3e+04	·	5.3e+04	·
	(6.5e+03)	(7.7e+03)		(8.3e+03)		(7.1e+03)	
f_5	0.0e+00	2.0e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(2.6e+00)		(0.0e+00)		(0.0e+00)	
f_6	2.7e+01	6.7e+01	+	3.1e+01	+	3.5e+01	+
	(1.9e+01)	(7.6e+00)		(1.2e+01)		(1.0e+01)	
f_7	6.3e+01	9.3e+01	+	6.9e+01	·	6.9e+01	+
	(8.5e+00)	(1.1e+01)		(7.8e+00)		(8.0e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.8e−02)	(4.9e−02)		(4.6e−02)		(5.5e−02)	
f_9	2.9e+01	3.1e+01	+	3.1e+01	+	3.1e+01	+
	(2.0e+00)	(1.1e+00)		(1.5e+00)		(1.3e+00)	
f_{10}	2.9e+00	1.0e+02	+	3.4e+01	+	3.4e+01	+
	(4.2e−01)	(1.5e+01)		(8.7e+00)		(5.9e+00)	
f_{11}	1.6e−02	3.6e+01	+	3.2e−06	−	1.8e+01	+
	(6.1e−03)	(2.7e+00)		(6.4e−06)		(2.0e+00)	
f_{12}	1.6e+02	1.9e+02	+	1.7e+02	+	1.6e+02	·
	(1.3e+01)	(1.1e+01)		(1.1e+01)		(1.4e+01)	
f_{13}	1.8e+02	2.0e+02	+	1.8e+02	·	1.8e+02	·
	(1.4e+01)	(1.0e+01)		(1.7e+01)		(1.1e+01)	
f_{14}	8.9e+02	8.1e+02	·	6.3e+01	−	1.0e+03	·
	(1.2e+02)	(8.8e+01)		(3.7e+01)		(1.2e+02)	
f_{15}	6.0e+03	6.4e+03	·	6.3e+03	·	6.3e+03	·
	(4.3e+02)	(3.2e+02)		(4.2e+02)		(3.1e+02)	
f_{16}	2.3e+00	2.4e+00	·	2.4e+00	·	2.3e+00	·
	(2.7e−01)	(2.4e−01)		(2.8e−01)		(2.4e−01)	
f_{17}	3.2e+01	8.8e+01	+	4.3e+01	+	5.1e+01	+
	(2.1e−01)	(4.0e+00)		(1.6e+00)		(1.7e+00)	
f_{18}	2.3e+02	2.7e+02	+	2.3e+02	+	2.2e+02	·
	(1.0e+01)	(1.4e+01)		(1.2e+01)		(9.8e+00)	
f_{19}	3.8e+00	9.1e+00	+	4.5e+00	+	4.0e+00	·
	(3.0e−01)	(9.3e−01)		(3.9e−01)		(3.8e−01)	
f_{20}	1.3e+01	1.4e+01	+	1.3e+01	·	1.3e+01	·
	(3.8e−01)	(3.3e−01)		(2.5e−01)		(2.9e−01)	
f_{21}	3.3e+02	5.4e+02	+	3.2e+02	·	3.7e+02	+
	(8.7e+01)	(2.2e+01)		(1.0e+02)		(5.3e+01)	
f_{22}	1.1e+03	1.3e+03	+	6.1e+02	−	1.2e+03	+
	(1.3e+02)	(1.5e+02)		(2.1e+02)		(1.7e+02)	
f_{23}	6.7e+03	7.0e+03	·	6.8e+03	·	6.8e+03	·
	(3.3e+02)	(3.4e+02)		(3.7e+02)		(4.0e+02)	
f_{24}	2.6e+02	2.8e+02	+	2.7e+02	+	2.7e+02	+
	(4.3e+00)	(4.3e+00)		(5.6e+00)		(4.5e+00)	
f_{25}	2.9e+02	2.9e+02	·	2.9e+02	·	2.9e+02	·
	(5.4e+00)	(3.5e+00)		(4.3e+00)		(5.3e+00)	
f_{26}	2.0e+02	2.0e+02	+	2.0e+02	+	2.0e+02	+
	(3.4e−01)	(8.6e−01)		(5.4e−01)		(4.1e−01)	
f_{27}	8.9e+02	1.0e+03	+	1.1e+03	+	1.1e+03	+
	(2.1e+02)	(9.4e+01)		(3.9e+01)		(4.7e+01)	
f_{28}	3.0e+02	7.9e+02	+	3.0e+02	+	3.5e+02	+
	(1.8e−05)	(3.3e+01)		(5.6e−05)		(1.8e+02)	
Summary (+/·/−)		22/6/0		13/12/3		14/14/0	

Table 117: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	2.0e−07	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(4.3e−08)		(0.0e+00)	
f_2	3.8e+07	4.0e+07	·	3.4e+07	−	3.8e+07	·
	(6.6e+06)	(7.3e+06)		(7.5e+06)		(6.4e+06)	
f_3	3.8e+09	3.7e+09	·	3.7e+09	·	4.3e+09	·
	(7.1e+08)	(6.6e+08)		(8.9e+08)		(9.1e+08)	
f_4	6.7e+04	6.7e+04	·	6.1e+04	·	6.4e+04	·
	(8.8e+03)	(8.5e+03)		(7.7e+03)		(7.7e+03)	
f_5	1.5e−07	1.4e−07	−	3.0e−05	+	4.0e−07	+
	(1.9e−08)	(2.3e−08)		(5.2e−06)		(6.0e−08)	
f_6	5.2e+01	5.2e+01	·	3.9e+01	−	5.6e+01	+
	(4.6e+00)	(3.7e+00)		(7.8e+00)		(5.5e+00)	
f_7	9.5e+01	9.5e+01	·	8.2e+01	−	9.3e+01	·
	(8.0e+00)	(8.5e+00)		(9.7e+00)		(9.0e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(6.0e−02)	(4.9e−02)		(6.2e−02)		(4.2e−02)	
f_9	3.1e+01	3.2e+01	·	3.1e+01	·	3.1e+01	·
	(1.1e+00)	(1.2e+00)		(1.3e+00)		(1.1e+00)	
f_{10}	7.6e+01	8.1e+01	·	9.5e+01	+	7.8e+01	·
	(1.1e+01)	(1.3e+01)		(1.6e+01)		(1.2e+01)	
f_{11}	1.9e−01	2.6e−02	−	2.5e−03	−	2.2e+01	+
	(1.0e−01)	(1.3e−02)		(1.7e−03)		(2.4e+00)	
f_{12}	1.9e+02	1.9e+02	·	2.0e+02	·	1.9e+02	·
	(1.2e+01)	(1.1e+01)		(1.2e+01)		(1.5e+01)	
f_{13}	2.0e+02	2.1e+02	·	2.1e+02	+	2.1e+02	·
	(1.1e+01)	(1.4e+01)		(1.3e+01)		(1.2e+01)	
f_{14}	5.0e+02	3.8e+02	−	2.2e+02	−	1.1e+03	+
	(7.2e+01)	(4.8e+01)		(6.1e+01)		(1.1e+02)	
f_{15}	6.5e+03	6.6e+03	·	6.4e+03	·	6.5e+03	·
	(3.4e+02)	(2.6e+02)		(3.2e+02)		(3.1e+02)	
f_{16}	2.4e+00	2.3e+00	·	2.4e+00	·	2.3e+00	·
	(2.6e−01)	(3.2e−01)		(2.4e−01)		(2.6e−01)	
f_{17}	4.3e+01	4.7e+01	+	5.3e+01	+	5.4e+01	+
	(1.1e+00)	(1.3e+00)		(2.4e+00)		(2.1e+00)	
f_{18}	2.4e+02	2.4e+02	·	2.6e+02	+	2.4e+02	·
	(1.2e+01)	(9.8e+00)		(1.4e+01)		(1.3e+01)	
f_{19}	4.7e+00	4.8e+00	·	5.8e+00	+	4.8e+00	·
	(4.1e−01)	(4.0e−01)		(4.4e−01)		(3.5e−01)	
f_{20}	1.4e+01	1.4e+01	·	1.3e+01	−	1.4e+01	·
	(2.6e−01)	(3.6e−01)		(2.3e−01)		(3.4e−01)	
f_{21}	3.3e+02	3.2e+02	·	3.0e+02	−	5.3e+02	+
	(2.3e+01)	(1.9e+01)		(9.2e+01)		(2.5e+01)	
f_{22}	1.4e+03	1.3e+03	·	8.2e+02	−	1.5e+03	+
	(1.6e+02)	(1.5e+02)		(1.9e+02)		(1.7e+02)	
f_{23}	7.1e+03	7.1e+03	·	6.9e+03	−	7.0e+03	·
	(3.2e+02)	(2.8e+02)		(3.3e+02)		(3.4e+02)	
f_{24}	2.8e+02	2.8e+02	·	2.8e+02	·	2.8e+02	−
	(3.4e+00)	(3.0e+00)		(4.7e+00)		(3.4e+00)	
f_{25}	3.0e+02	2.9e+02	·	3.0e+02	·	3.0e+02	·
	(3.4e+00)	(3.5e+00)		(3.5e+00)		(3.5e+00)	
f_{26}	2.0e+02	2.0e+02	·	2.0e+02	−	2.0e+02	·
	(8.5e−01)	(9.4e−01)		(6.4e−01)		(7.1e−01)	
f_{27}	1.1e+03	1.0e+03	·	1.1e+03	·	1.1e+03	·
	(8.7e+01)	(1.1e+02)		(1.1e+02)		(8.1e+01)	
f_{28}	3.0e+02	3.0e+02	·	3.0e+02	+	5.0e+02	+
	(7.9e−02)	(7.6e−02)		(3.0e−01)		(5.1e+01)	
Summary (+/·/−)		1/24/3		8/10/10		8/19/1	

Table 118: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	2.1e+07	3.5e+07	+	3.3e+07	+	3.0e+07	+
	(3.4e+06)	(6.3e+06)		(6.5e+06)		(6.5e+06)	
f_3	4.9e+08	1.0e+09	+	2.5e+09	+	2.6e+09	+
	(1.3e+08)	(2.4e+08)		(7.6e+08)		(6.0e+08)	
f_4	5.5e+04	6.9e+04	+	5.8e+04	·	5.5e+04	·
	(7.0e+03)	(7.9e+03)		(8.5e+03)		(8.6e+03)	
f_5	0.0e+00	0.0e+00	·	1.4e−07	+	4.6e−07	+
	(0.0e+00)	(0.0e+00)		(3.4e−08)		(8.9e−08)	
f_6	2.6e+01	4.9e+01	+	3.3e+01	+	3.8e+01	+
	(8.8e+00)	(3.0e+00)		(7.6e+00)		(8.4e+00)	
f_7	6.9e+01	9.0e+01	+	7.8e+01	+	7.7e+01	·
	(8.1e+00)	(1.0e+01)		(9.5e+00)		(9.4e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.6e−02)	(5.0e−02)		(4.7e−02)		(5.3e−02)	
f_9	3.0e+01	3.2e+01	+	3.1e+01	+	3.1e+01	+
	(1.3e+00)	(1.2e+00)		(1.5e+00)		(1.2e+00)	
f_{10}	3.8e+00	2.6e+01	+	5.9e+01	+	7.2e+01	+
	(6.8e−01)	(4.9e+00)		(1.1e+01)		(1.1e+01)	
f_{11}	1.9e−02	0.0e+00	−	1.5e−03	−	2.6e+01	+
	(5.4e−03)	(0.0e+00)		(4.3e−03)		(1.7e+00)	
f_{12}	1.6e+02	1.7e+02	·	1.9e+02	+	1.8e+02	+
	(1.5e+01)	(1.3e+01)		(1.1e+01)		(1.5e+01)	
f_{13}	1.8e+02	1.8e+02	·	2.0e+02	+	2.0e+02	+
	(1.5e+01)	(1.2e+01)		(1.2e+01)		(1.1e+01)	
f_{14}	8.8e+02	2.5e+01	−	1.4e+02	−	1.1e+03	+
	(1.3e+02)	(7.4e+00)		(4.9e+01)		(1.1e+02)	
f_{15}	6.1e+03	6.5e+03	+	6.3e+03	+	6.3e+03	+
	(2.5e+02)	(2.6e+02)		(3.3e+02)		(3.4e+02)	
f_{16}	2.3e+00	2.4e+00	·	2.4e+00	·	2.3e+00	·
	(3.0e−01)	(2.7e−01)		(3.2e−01)		(3.1e−01)	
f_{17}	3.2e+01	3.7e+01	+	4.8e+01	+	5.9e+01	+
	(1.6e−01)	(8.6e−01)		(2.3e+00)		(2.4e+00)	
f_{18}	2.2e+02	2.2e+02	·	2.4e+02	+	2.5e+02	+
	(1.0e+01)	(1.1e+01)		(1.2e+01)		(1.3e+01)	
f_{19}	3.7e+00	2.1e+00	−	5.1e+00	+	5.0e+00	+
	(3.2e−01)	(3.2e−01)		(4.2e−01)		(4.0e−01)	
f_{20}	1.4e+01	1.4e+01	+	1.3e+01	·	1.3e+01	·
	(4.1e−01)	(2.6e−01)		(2.7e−01)		(2.5e−01)	
f_{21}	3.1e+02	2.9e+02	·	3.0e+02	·	3.7e+02	+
	(7.4e+01)	(1.8e+01)		(8.7e+01)		(5.5e+01)	
f_{22}	1.0e+03	5.3e+02	−	6.8e+02	−	1.4e+03	+
	(1.2e+02)	(1.0e+02)		(1.9e+02)		(1.5e+02)	
f_{23}	6.7e+03	7.0e+03	+	6.8e+03	·	6.9e+03	·
	(4.0e+02)	(3.3e+02)		(3.4e+02)		(3.5e+02)	
f_{24}	2.6e+02	2.8e+02	+	2.8e+02	+	2.7e+02	+
	(4.1e+00)	(3.9e+00)		(5.3e+00)		(4.4e+00)	
f_{25}	3.0e+02	2.9e+02	−	2.9e+02	−	2.9e+02	·
	(3.8e+00)	(4.1e+00)		(4.4e+00)		(4.2e+00)	
f_{26}	2.0e+02	2.0e+02	+	2.0e+02	+	2.0e+02	+
	(4.2e−01)	(8.1e−01)		(5.7e−01)		(5.6e−01)	
f_{27}	8.7e+02	1.0e+03	+	1.1e+03	+	1.1e+03	+
	(1.8e+02)	(8.3e+01)		(1.1e+02)		(7.9e+01)	
f_{28}	3.0e+02	3.0e+02	·	3.0e+02	+	3.5e+02	+
	(1.6e−05)	(2.4e−04)		(3.6e−03)		(5.8e+01)	
Summary (+/·/−)		14/9/5		17/7/4		20/8/0	

Table 119: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	1.7e−05	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(4.3e−06)		(0.0e+00)	
f_2	9.5e+07	9.7e+07	·	8.5e+07	·	8.0e+07	−
	(1.7e+07)	(1.6e+07)		(2.0e+07)		(1.6e+07)	
f_3	4.4e+08	4.8e+08	·	2.9e+09	+	1.2e+09	+
	(1.0e+08)	(8.2e+07)		(5.3e+08)		(2.4e+08)	
f_4	6.6e+04	6.5e+04	·	4.6e+04	−	6.1e+04	·
	(7.7e+03)	(8.4e+03)		(6.3e+03)		(6.9e+03)	
f_5	1.5e−07	1.4e−07	·	2.5e−03	+	1.8e−08	−
	(2.3e−08)	(2.7e−08)		(6.9e−04)		(2.2e−09)	
f_6	4.4e+01	4.4e+01	·	3.9e+01	·	5.1e+01	+
	(5.4e−01)	(3.7e−01)		(9.8e+00)		(3.2e+00)	
f_7	6.1e+01	6.1e+01	·	7.1e+01	+	6.3e+01	·
	(4.4e+00)	(5.1e+00)		(7.4e+00)		(6.1e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.4e−02)	(5.1e−02)		(6.0e−02)		(4.3e−02)	
f_9	3.8e+01	3.8e+01	·	3.7e+01	·	3.7e+01	·
	(1.1e+00)	(1.1e+00)		(1.3e+00)		(1.3e+00)	
f_{10}	9.1e+01	9.0e+01	·	1.9e+02	+	9.6e+01	·
	(1.5e+01)	(1.3e+01)		(3.6e+01)		(1.4e+01)	
f_{11}	5.8e+01	5.7e+01	·	2.7e+01	−	7.6e+01	+
	(4.1e+00)	(5.6e+00)		(6.0e+00)		(5.3e+00)	
f_{12}	2.0e+02	2.0e+02	·	2.2e+02	+	2.0e+02	·
	(1.0e+01)	(1.1e+01)		(8.8e+00)		(1.2e+01)	
f_{13}	2.0e+02	2.0e+02	·	2.2e+02	+	2.0e+02	·
	(1.1e+01)	(9.5e+00)		(1.3e+01)		(9.2e+00)	
f_{14}	2.4e+03	2.5e+03	·	8.8e+02	−	3.7e+03	+
	(2.7e+02)	(2.0e+02)		(2.5e+02)		(1.8e+02)	
f_{15}	7.4e+03	7.3e+03	·	7.3e+03	·	7.2e+03	·
	(2.1e+02)	(2.5e+02)		(2.7e+02)		(3.3e+02)	
f_{16}	2.4e+00	2.4e+00	·	2.4e+00	·	2.5e+00	·
	(2.7e−01)	(2.5e−01)		(3.3e−01)		(2.5e−01)	
f_{17}	9.1e+01	8.9e+01	·	9.0e+01	·	1.1e+02	+
	(5.1e+00)	(5.0e+00)		(8.1e+00)		(4.7e+00)	
f_{18}	2.3e+02	2.3e+02	·	2.6e+02	+	2.3e+02	·
	(9.5e+00)	(9.7e+00)		(1.1e+01)		(9.2e+00)	
f_{19}	1.0e+01	1.0e+01	·	1.3e+01	+	1.0e+01	·
	(6.2e−01)	(6.0e−01)		(1.0e+00)		(8.1e−01)	
f_{20}	1.3e+01	1.3e+01	·	1.3e+01	−	1.4e+01	+
	(2.4e−01)	(2.8e−01)		(2.5e−01)		(2.4e−01)	
f_{21}	2.7e+02	2.7e+02	·	2.9e+02	·	5.9e+02	+
	(3.2e+01)	(3.1e+01)		(7.6e+01)		(8.4e+01)	
f_{22}	3.4e+03	3.4e+03	·	1.3e+03	−	4.0e+03	+
	(2.6e+02)	(3.4e+02)		(3.7e+02)		(1.9e+02)	
f_{23}	7.6e+03	7.7e+03	·	7.5e+03	·	7.6e+03	·
	(2.7e+02)	(2.6e+02)		(2.8e+02)		(3.6e+02)	
f_{24}	2.8e+02	2.8e+02	·	2.8e+02	·	2.8e+02	−
	(3.9e+00)	(3.1e+00)		(5.2e+00)		(2.9e+00)	
f_{25}	3.0e+02	3.0e+02	·	3.0e+02	·	3.1e+02	+
	(2.8e+00)	(2.5e+00)		(6.7e+00)		(2.9e+00)	
f_{26}	2.1e+02	2.1e+02	·	2.1e+02	−	2.1e+02	·
	(2.7e+00)	(2.8e+00)		(1.5e+00)		(2.2e+00)	
f_{27}	1.2e+03	1.2e+03	·	1.2e+03	·	1.2e+03	−
	(3.0e+01)	(3.3e+01)		(3.2e+01)		(2.8e+01)	
f_{28}	3.0e+02	3.0e+02	·	3.0e+02	+	3.0e+02	−
	(6.8e−05)	(8.0e−05)		(1.1e−01)		(2.3e−03)	
Summary (+/·/−)		0/28/0		10/12/6		9/14/5	

Table 120: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.5e−04	1.4e−04	·	1.0e−01	+	7.6e−05	−
	(2.8e−05)	(2.1e−05)		(2.6e−02)		(1.3e−05)	
f_2	1.1e+08	1.0e+08	·	9.2e+07	·	1.0e+08	·
	(1.5e+07)	(2.0e+07)		(1.9e+07)		(1.7e+07)	
f_3	4.2e+09	3.6e+09	−	5.7e+09	+	4.7e+09	+
	(5.0e+08)	(5.4e+08)		(1.0e+09)		(5.0e+08)	
f_4	6.7e+04	6.6e+04	·	5.2e+04	−	6.4e+04	·
	(8.3e+03)	(8.3e+03)		(6.2e+03)		(7.6e+03)	
f_5	8.2e−03	8.4e−03	·	5.4e−01	+	3.4e−03	−
	(9.2e−04)	(1.2e−03)		(8.1e−02)		(3.7e−04)	
f_6	7.5e+01	7.1e+01	−	7.1e+01	·	8.5e+01	+
	(5.6e+00)	(6.0e+00)		(1.0e+01)		(6.8e+00)	
f_7	8.2e+01	8.3e+01	·	8.5e+01	·	8.5e+01	·
	(7.3e+00)	(5.3e+00)		(7.6e+00)		(5.6e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(7.1e−02)	(7.0e−02)		(6.4e−02)		(4.8e−02)	
f_9	3.7e+01	3.8e+01	·	3.8e+01	·	3.8e+01	·
	(1.6e+00)	(1.2e+00)		(1.4e+00)		(1.1e+00)	
f_{10}	3.0e+02	2.9e+02	·	3.4e+02	+	2.8e+02	·
	(4.1e+01)	(3.6e+01)		(4.6e+01)		(3.8e+01)	
f_{11}	9.3e+01	7.9e+01	−	1.5e+01	−	9.4e+01	·
	(6.3e+00)	(5.1e+00)		(2.8e+00)		(5.0e+00)	
f_{12}	2.2e+02	2.2e+02	·	2.3e+02	+	2.2e+02	·
	(1.1e+01)	(1.2e+01)		(1.0e+01)		(8.8e+00)	
f_{13}	2.2e+02	2.2e+02	·	2.4e+02	+	2.2e+02	·
	(1.0e+01)	(1.2e+01)		(1.2e+01)		(1.3e+01)	
f_{14}	3.6e+03	2.6e+03	−	4.9e+02	−	3.7e+03	+
	(2.1e+02)	(2.4e+02)		(1.0e+02)		(1.7e+02)	
f_{15}	7.2e+03	7.3e+03	·	7.3e+03	·	7.3e+03	·
	(3.0e+02)	(2.5e+02)		(2.3e+02)		(2.7e+02)	
f_{16}	2.4e+00	2.5e+00	·	2.4e+00	·	2.5e+00	·
	(3.1e−01)	(3.1e−01)		(3.1e−01)		(2.3e−01)	
f_{17}	1.3e+02	1.2e+02	−	5.8e+01	−	1.3e+02	·
	(5.4e+00)	(6.5e+00)		(8.1e+00)		(5.8e+00)	
f_{18}	2.6e+02	2.6e+02	·	2.8e+02	+	2.6e+02	·
	(9.3e+00)	(1.1e+01)		(1.5e+01)		(9.6e+00)	
f_{19}	1.3e+01	1.3e+01	·	1.6e+01	+	1.3e+01	·
	(8.2e−01)	(8.5e−01)		(1.1e+00)		(7.4e−01)	
f_{20}	1.4e+01	1.4e+01	·	1.3e+01	−	1.4e+01	·
	(2.0e−01)	(2.3e−01)		(1.9e−01)		(2.7e−01)	
f_{21}	5.0e+02	4.4e+02	·	3.3e+02	−	8.4e+02	+
	(1.1e+02)	(8.4e+01)		(7.2e+01)		(6.6e+01)	
f_{22}	4.2e+03	3.6e+03	−	1.1e+03	−	4.2e+03	·
	(2.1e+02)	(2.5e+02)		(4.2e+02)		(2.5e+02)	
f_{23}	7.7e+03	7.7e+03	·	7.5e+03	·	7.7e+03	·
	(3.0e+02)	(2.3e+02)		(2.9e+02)		(3.0e+02)	
f_{24}	2.9e+02	2.9e+02	·	2.9e+02	·	2.8e+02	·
	(3.9e+00)	(3.6e+00)		(4.3e+00)		(3.7e+00)	
f_{25}	3.1e+02	3.1e+02	·	3.0e+02	·	3.1e+02	·
	(3.3e+00)	(3.3e+00)		(4.4e+00)		(3.4e+00)	
f_{26}	2.1e+02	2.1e+02	·	2.1e+02	−	2.1e+02	·
	(2.6e+00)	(2.9e+00)		(1.6e+00)		(2.4e+00)	
f_{27}	1.2e+03	1.2e+03	·	1.2e+03	−	1.2e+03	·
	(2.9e+01)	(2.1e+01)		(3.5e+01)		(2.6e+01)	
f_{28}	3.0e+02	3.0e+02	·	3.4e+02	+	3.1e+02	−
	(2.7e−01)	(2.5e−01)		(5.1e+00)		(3.2e+01)	
Summary (+/·/−)		0/22/6		9/10/9		4/21/3	

Table 121: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	2.7e+03	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(2.9e+02)		(0.0e+00)		(0.0e+00)	
f_2	3.0e+07	1.0e+08	+	2.9e+07	·	3.4e+07	·
	(7.7e+06)	(1.8e+07)		(9.0e+06)		(1.1e+07)	
f_3	4.2e+07	1.4e+10	+	6.4e+07	·	9.9e+07	+
	(8.0e+07)	(2.0e+09)		(2.2e+08)		(9.2e+07)	
f_4	2.7e+04	6.4e+04	+	2.7e+04	·	2.7e+04	·
	(4.7e+03)	(8.5e+03)		(4.7e+03)		(4.5e+03)	
f_5	0.0e+00	3.6e+02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(4.2e+01)		(0.0e+00)		(0.0e+00)	
f_6	2.5e+01	2.7e+02	+	2.5e+01	·	2.8e+01	·
	(1.8e+01)	(2.6e+01)		(1.7e+01)		(1.7e+01)	
f_7	2.3e+01	1.2e+02	+	2.2e+01	·	2.7e+01	·
	(1.1e+01)	(9.5e+00)		(9.9e+00)		(8.0e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.3e−02)	(5.1e−02)		(5.4e−02)		(5.7e−02)	
f_9	3.4e+01	3.8e+01	+	3.3e+01	·	3.4e+01	·
	(3.0e+00)	(1.2e+00)		(2.8e+00)		(2.0e+00)	
f_{10}	3.3e−01	6.1e+02	+	2.8e−01	·	1.6e+00	+
	(4.5e−01)	(8.0e+01)		(4.1e−01)		(6.9e−01)	
f_{11}	5.7e+00	1.5e+02	+	5.7e+00	·	6.4e+01	+
	(3.0e+00)	(1.2e+01)		(3.2e+00)		(6.8e+00)	
f_{12}	1.7e+02	2.7e+02	+	1.7e+02	·	1.8e+02	·
	(1.3e+01)	(1.2e+01)		(1.1e+01)		(9.7e+00)	
f_{13}	1.8e+02	2.7e+02	+	1.8e+02	·	1.8e+02	·
	(1.2e+01)	(1.3e+01)		(1.2e+01)		(1.2e+01)	
f_{14}	2.9e+02	2.9e+03	+	2.7e+02	·	3.2e+03	+
	(2.0e+02)	(2.6e+02)		(1.6e+02)		(3.0e+02)	
f_{15}	7.2e+03	7.3e+03	·	7.2e+03	·	7.2e+03	·
	(3.2e+02)	(2.4e+02)		(2.7e+02)		(2.6e+02)	
f_{16}	2.4e+00	2.4e+00	·	2.5e+00	·	2.5e+00	·
	(2.8e−01)	(2.8e−01)		(2.5e−01)		(2.1e−01)	
f_{17}	5.2e+01	3.5e+02	+	5.2e+01	·	1.0e+02	+
	(6.4e+00)	(2.3e+01)		(3.4e+00)		(6.9e+00)	
f_{18}	2.1e+02	4.1e+02	+	2.1e+02	·	2.1e+02	·
	(1.1e+01)	(2.1e+01)		(1.4e+01)		(1.1e+01)	
f_{19}	8.0e+00	9.7e+01	+	8.1e+00	·	8.6e+00	+
	(8.5e−01)	(2.3e+01)		(7.9e−01)		(7.5e−01)	
f_{20}	1.2e+01	1.3e+01	+	1.3e+01	·	1.3e+01	·
	(2.9e−01)	(2.7e−01)		(2.9e−01)		(2.3e−01)	
f_{21}	3.0e+02	1.4e+03	+	3.0e+02	·	3.0e+02	·
	(7.9e+01)	(6.7e+01)		(7.7e+01)		(7.3e+01)	
f_{22}	3.2e+02	3.6e+03	+	3.2e+02	·	3.3e+03	+
	(1.7e+02)	(2.6e+02)		(2.3e+02)		(2.8e+02)	
f_{23}	7.2e+03	7.7e+03	+	7.3e+03	·	7.2e+03	·
	(3.5e+02)	(3.1e+02)		(3.2e+02)		(3.3e+02)	
f_{24}	2.4e+02	2.9e+02	+	2.3e+02	·	2.5e+02	·
	(1.6e+01)	(4.5e+00)		(2.2e+01)		(1.9e+01)	
f_{25}	2.6e+02	3.1e+02	+	2.6e+02	·	2.8e+02	+
	(1.1e+01)	(3.4e+00)		(1.0e+01)		(8.3e+00)	
f_{26}	2.2e+02	2.1e+02	+	2.1e+02	·	2.1e+02	·
	(4.9e+01)	(2.6e+00)		(3.2e+01)		(3.2e+01)	
f_{27}	8.8e+02	1.2e+03	+	9.3e+02	·	9.8e+02	·
	(2.0e+02)	(2.8e+01)		(1.6e+02)		(1.0e+02)	
f_{28}	3.2e+02	1.8e+03	+	3.2e+02	·	3.0e+02	+
	(1.5e+02)	(7.1e+01)		(1.5e+02)		(2.7e−13)	
Summary (+/·/−)		25/3/0		0/28/0		9/19/0	

Table 122: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	9.2e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(3.4e+01)		(0.0e+00)		(0.0e+00)	
f_2	5.9e+07	7.4e+07	+	6.2e+07	·	6.1e+07	·
	(1.2e+07)	(1.1e+07)		(1.4e+07)		(1.4e+07)	
f_3	8.6e+08	6.1e+08	−	4.5e+08	−	1.1e+09	·
	(3.4e+08)	(2.7e+08)		(2.2e+08)		(4.0e+08)	
f_4	3.6e+04	6.3e+04	+	3.9e+04	·	3.9e+04	·
	(6.2e+03)	(7.7e+03)		(5.4e+03)		(6.9e+03)	
f_5	0.0e+00	4.1e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(2.3e+01)		(0.0e+00)		(0.0e+00)	
f_6	2.3e+01	8.1e+01	+	2.3e+01	·	3.4e+01	+
	(7.3e+00)	(1.3e+01)		(9.3e+00)		(1.2e+01)	
f_7	5.2e+01	3.8e+01	−	4.9e+01	·	5.3e+01	·
	(5.7e+00)	(9.0e+00)		(7.3e+00)		(6.1e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.1e−02)	(4.6e−02)		(4.8e−02)		(4.4e−02)	
f_9	3.7e+01	3.8e+01	+	3.7e+01	·	3.6e+01	·
	(1.3e+00)	(9.9e−01)		(1.6e+00)		(1.3e+00)	
f_{10}	4.2e+01	1.9e+01	−	2.6e+01	−	5.4e+01	·
	(1.2e+01)	(8.3e+00)		(9.0e+00)		(1.5e+01)	
f_{11}	7.6e+01	2.7e+01	−	1.7e+01	−	8.5e+01	+
	(6.1e+00)	(5.0e+00)		(9.4e+00)		(5.8e+00)	
f_{12}	2.0e+02	1.7e+02	−	2.0e+02	·	2.0e+02	·
	(9.2e+00)	(1.0e+01)		(1.0e+01)		(1.3e+01)	
f_{13}	2.0e+02	1.7e+02	−	2.0e+02	·	2.0e+02	·
	(1.0e+01)	(1.1e+01)		(1.1e+01)		(1.1e+01)	
f_{14}	3.3e+03	1.4e+02	−	7.8e+02	−	3.5e+03	+
	(2.3e+02)	(4.1e+01)		(3.4e+02)		(2.3e+02)	
f_{15}	7.2e+03	7.3e+03	·	7.2e+03	·	7.2e+03	·
	(2.9e+02)	(2.8e+02)		(2.5e+02)		(2.6e+02)	
f_{16}	2.4e+00	2.5e+00	·	2.4e+00	·	2.5e+00	·
	(3.2e−01)	(3.1e−01)		(2.9e−01)		(2.8e−01)	
f_{17}	1.1e+02	8.0e+01	−	7.2e+01	−	1.2e+02	+
	(6.7e+00)	(7.5e+00)		(5.9e+00)		(5.4e+00)	
f_{18}	2.3e+02	2.0e+02	−	2.3e+02	·	2.4e+02	·
	(1.0e+01)	(1.0e+01)		(1.0e+01)		(1.1e+01)	
f_{19}	1.1e+01	6.4e+00	−	1.1e+01	·	1.1e+01	·
	(8.4e−01)	(1.2e+00)		(9.4e−01)		(8.5e−01)	
f_{20}	1.3e+01	1.3e+01	·	1.3e+01	·	1.3e+01	·
	(2.1e−01)	(2.5e−01)		(2.5e−01)		(2.6e−01)	
f_{21}	3.1e+02	6.0e+02	+	2.9e+02	·	2.9e+02	·
	(7.9e+01)	(1.1e+02)		(7.6e+01)		(6.9e+01)	
f_{22}	3.6e+03	3.0e+02	−	1.0e+03	−	3.7e+03	·
	(2.4e+02)	(5.9e+01)		(4.0e+02)		(2.7e+02)	
f_{23}	7.4e+03	7.6e+03	·	7.5e+03	·	7.3e+03	·
	(3.6e+02)	(3.1e+02)		(3.0e+02)		(4.0e+02)	
f_{24}	2.7e+02	2.4e+02	−	2.7e+02	·	2.7e+02	·
	(7.4e+00)	(1.4e+01)		(9.8e+00)		(7.1e+00)	
f_{25}	2.9e+02	2.9e+02	·	2.9e+02	·	2.9e+02	·
	(7.9e+00)	(3.9e+00)		(7.4e+00)		(5.8e+00)	
f_{26}	2.0e+02	2.1e+02	+	2.0e+02	·	2.1e+02	·
	(1.1e+00)	(1.9e+00)		(1.0e+00)		(1.1e+00)	
f_{27}	1.2e+03	1.2e+03	·	1.1e+03	·	1.2e+03	·
	(4.9e+01)	(4.7e+01)		(5.9e+01)		(5.1e+01)	
f_{28}	3.0e+02	7.0e+02	+	3.0e+02	−	3.0e+02	·
	(3.6e−06)	(7.0e+01)		(4.4e−06)		(4.6e−06)	
Summary (+/·/−)		9/7/12		0/21/7		4/24/0	

Table 123: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	1.1e+02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(4.2e+01)		(0.0e+00)		(0.0e+00)	
f_2	3.3e+07	7.3e+07	+	6.4e+07	+	4.9e+07	+
	(5.8e+06)	(1.3e+07)		(1.5e+07)		(5.6e+06)	
f_3	1.0e+07	5.6e+08	+	4.9e+08	+	2.6e+07	+
	(2.6e+06)	(2.2e+08)		(2.8e+08)		(1.6e+07)	
f_4	5.2e+04	6.3e+04	+	3.9e+04	−	5.1e+04	·
	(6.7e+03)	(8.3e+03)		(6.7e+03)		(5.7e+03)	
f_5	4.7e−06	4.5e+01	+	0.0e+00	·	0.0e+00	·
	(3.1e−05)	(1.9e+01)		(0.0e+00)		(0.0e+00)	
f_6	3.5e+01	8.3e+01	+	2.1e+01	−	4.3e+01	+
	(1.7e+01)	(1.3e+01)		(9.1e+00)		(6.5e+00)	
f_7	4.6e+01	3.9e+01	·	5.0e+01	·	3.1e+01	−
	(5.0e+00)	(7.1e+00)		(8.0e+00)		(3.4e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.1e−02)	(4.7e−02)		(5.5e−02)		(3.7e−02)	
f_9	3.5e+01	3.8e+01	+	3.6e+01	+	3.7e+01	+
	(1.2e+00)	(1.1e+00)		(1.5e+00)		(1.1e+00)	
f_{10}	1.4e+00	1.9e+01	+	2.5e+01	+	1.3e+00	·
	(5.3e−01)	(6.2e+00)		(9.2e+00)		(2.1e−01)	
f_{11}	5.4e+01	2.9e+01	−	1.5e+01	−	6.0e+01	+
	(3.9e+00)	(5.6e+00)		(8.0e+00)		(4.7e+00)	
f_{12}	1.9e+02	1.7e+02	−	2.0e+02	+	1.7e+02	−
	(1.2e+01)	(1.2e+01)		(1.0e+01)		(9.3e+00)	
f_{13}	1.9e+02	1.7e+02	−	2.0e+02	+	1.7e+02	−
	(9.4e+00)	(9.5e+00)		(1.3e+01)		(9.9e+00)	
f_{14}	3.5e+03	1.5e+02	−	6.6e+02	−	3.4e+03	−
	(2.1e+02)	(4.4e+01)		(2.8e+02)		(2.3e+02)	
f_{15}	7.2e+03	7.2e+03	·	7.2e+03	·	7.3e+03	·
	(3.1e+02)	(3.1e+02)		(3.1e+02)		(2.2e+02)	
f_{16}	2.4e+00	2.3e+00	·	2.4e+00	·	2.5e+00	·
	(3.0e−01)	(3.6e−01)		(2.6e−01)		(2.7e−01)	
f_{17}	7.9e+01	8.3e+01	·	7.1e+01	−	9.0e+01	+
	(4.8e+00)	(9.5e+00)		(9.1e+00)		(5.3e+00)	
f_{18}	2.1e+02	2.0e+02	·	2.3e+02	+	2.0e+02	−
	(7.8e+00)	(1.0e+01)		(1.1e+01)		(9.2e+00)	
f_{19}	7.6e+00	6.1e+00	−	1.1e+01	+	8.0e+00	·
	(7.2e−01)	(1.3e+00)		(7.2e−01)		(5.1e−01)	
f_{20}	1.4e+01	1.3e+01	−	1.3e+01	−	1.4e+01	·
	(2.3e−01)	(2.5e−01)		(2.5e−01)		(3.1e−01)	
f_{21}	3.0e+02	5.9e+02	+	3.0e+02	·	3.5e+02	+
	(2.1e−02)	(7.2e+01)		(8.4e+01)		(4.5e+01)	
f_{22}	3.8e+03	3.0e+02	−	9.3e+02	−	3.6e+03	·
	(2.4e+02)	(6.7e+01)		(4.4e+02)		(2.2e+02)	
f_{23}	7.5e+03	7.5e+03	·	7.4e+03	·	7.7e+03	·
	(3.3e+02)	(3.2e+02)		(2.9e+02)		(2.4e+02)	
f_{24}	2.3e+02	2.4e+02	·	2.7e+02	+	2.3e+02	−
	(4.2e+00)	(1.1e+01)		(7.5e+00)		(4.2e+00)	
f_{25}	3.0e+02	2.9e+02	−	2.9e+02	−	3.0e+02	·
	(3.1e+00)	(4.1e+00)		(7.5e+00)		(3.1e+00)	
f_{26}	2.0e+02	2.1e+02	+	2.0e+02	·	2.1e+02	+
	(7.5e−01)	(2.2e+00)		(1.1e+00)		(1.6e+00)	
f_{27}	1.0e+03	1.2e+03	+	1.2e+03	+	9.9e+02	−
	(3.9e+01)	(4.1e+01)		(5.8e+01)		(3.4e+01)	
f_{28}	3.0e+02	7.1e+02	+	3.0e+02	+	3.0e+02	−
	(1.5e−10)	(7.2e+01)		(4.2e−06)		(2.0e+00)	
Summary (+/·/−)		12/8/8		11/9/8		8/12/8	

Table 124: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	9.8e+02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.0e+02)		(0.0e+00)		(0.0e+00)	
f_2	1.8e+07	8.4e+07	+	4.7e+07	+	4.2e+07	+
	(3.4e+06)	(1.7e+07)		(1.0e+07)		(1.1e+07)	
f_3	4.1e+06	5.5e+09	+	1.2e+08	+	6.2e+07	+
	(8.2e+06)	(7.9e+08)		(1.9e+08)		(6.0e+07)	
f_4	2.9e+04	6.4e+04	+	3.3e+04	·	3.1e+04	·
	(4.9e+03)	(8.4e+03)		(6.0e+03)		(4.6e+03)	
f_5	0.0e+00	1.7e+02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.7e+01)		(0.0e+00)		(0.0e+00)	
f_6	4.3e+01	1.5e+02	+	2.2e+01	−	2.8e+01	−
	(2.5e+01)	(1.1e+01)		(1.3e+01)		(1.8e+01)	
f_7	1.6e+01	8.0e+01	+	3.5e+01	+	2.6e+01	+
	(1.1e+01)	(6.3e+00)		(8.4e+00)		(4.9e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.6e−02)	(4.9e−02)		(4.6e−02)		(4.3e−02)	
f_9	3.4e+01	3.8e+01	+	3.6e+01	+	3.6e+01	+
	(1.6e+00)	(1.2e+00)		(1.6e+00)		(1.9e+00)	
f_{10}	3.2e−01	3.0e+02	+	1.6e+00	+	1.9e+00	+
	(4.7e−01)	(4.3e+01)		(4.0e−01)		(7.6e−01)	
f_{11}	4.6e+01	1.0e+02	+	7.0e+00	−	6.6e+01	+
	(4.5e+00)	(8.1e+00)		(3.2e+00)		(6.3e+00)	
f_{12}	1.7e+02	2.3e+02	+	1.9e+02	+	1.8e+02	+
	(9.3e+00)	(1.0e+01)		(1.1e+01)		(1.1e+01)	
f_{13}	1.7e+02	2.3e+02	+	1.9e+02	+	1.8e+02	·
	(1.1e+01)	(1.2e+01)		(1.1e+01)		(1.0e+01)	
f_{14}	3.3e+03	2.7e+03	−	4.1e+02	−	3.3e+03	·
	(2.2e+02)	(2.2e+02)		(2.9e+02)		(2.6e+02)	
f_{15}	7.1e+03	7.3e+03	·	7.2e+03	·	7.2e+03	·
	(3.3e+02)	(2.6e+02)		(3.3e+02)		(3.8e+02)	
f_{16}	2.4e+00	2.5e+00	·	2.4e+00	·	2.4e+00	·
	(3.2e−01)	(2.5e−01)		(2.6e−01)		(2.7e−01)	
f_{17}	7.7e+01	2.1e+02	+	6.5e+01	−	9.8e+01	+
	(2.7e+00)	(1.3e+01)		(4.4e+00)		(5.6e+00)	
f_{18}	2.0e+02	3.1e+02	+	2.2e+02	+	2.1e+02	·
	(9.8e+00)	(1.5e+01)		(1.1e+01)		(9.4e+00)	
f_{19}	7.8e+00	3.1e+01	+	9.5e+00	+	8.7e+00	+
	(7.3e−01)	(2.8e+00)		(7.0e−01)		(6.7e−01)	
f_{20}	1.3e+01	1.3e+01	+	1.3e+01	·	1.3e+01	·
	(2.3e−01)	(2.5e−01)		(2.3e−01)		(2.4e−01)	
f_{21}	3.0e+02	9.1e+02	+	2.9e+02	+	2.9e+02	+
	(6.8e+01)	(5.2e+01)		(6.0e+01)		(6.1e+01)	
f_{22}	3.3e+03	3.4e+03	·	5.5e+02	−	3.4e+03	·
	(3.1e+02)	(2.7e+02)		(4.2e+02)		(2.8e+02)	
f_{23}	7.4e+03	7.6e+03	·	7.3e+03	·	7.4e+03	·
	(3.1e+02)	(2.8e+02)		(3.1e+02)		(2.8e+02)	
f_{24}	2.1e+02	2.8e+02	+	2.6e+02	+	2.4e+02	+
	(1.0e+01)	(3.4e+00)		(1.9e+01)		(1.3e+01)	
f_{25}	2.8e+02	3.0e+02	+	2.8e+02	·	2.8e+02	+
	(1.5e+01)	(3.3e+00)		(1.3e+01)		(8.2e+00)	
f_{26}	2.0e+02	2.1e+02	+	2.0e+02	+	2.0e+02	+
	(3.3e−01)	(2.7e+00)		(9.0e−01)		(7.4e−01)	
f_{27}	8.3e+02	1.2e+03	+	1.1e+03	+	1.0e+03	+
	(2.1e+02)	(3.1e+01)		(7.7e+01)		(8.6e+01)	
f_{28}	3.0e+02	1.4e+03	+	3.4e+02	+	3.2e+02	+
	(2.9e−13)	(4.5e+01)		(2.2e+02)		(1.6e+02)	
Summary (+/·/−)		22/5/1		14/9/5		15/12/1	

Table 125: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	3.2e−06	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(1.1e−06)		(0.0e+00)	
f_2	8.5e+07	8.9e+07	·	7.7e+07	·	8.0e+07	·
	(1.5e+07)	(1.6e+07)		(1.8e+07)		(1.3e+07)	
f_3	2.9e+08	2.6e+08	·	2.5e+09	+	8.2e+08	+
	(6.5e+07)	(5.5e+07)		(6.8e+08)		(1.8e+08)	
f_4	6.3e+04	6.1e+04	·	4.5e+04	−	6.1e+04	·
	(7.9e+03)	(9.1e+03)		(6.2e+03)		(6.9e+03)	
f_5	2.3e−09	1.6e−08	+	9.1e−04	+	0.0e+00	·
	(4.4e−09)	(3.2e−09)		(2.2e−04)		(0.0e+00)	
f_6	4.4e+01	4.4e+01	·	3.5e+01	−	4.8e+01	+
	(1.3e+00)	(3.7e−01)		(9.4e+00)		(3.1e+00)	
f_7	5.5e+01	5.6e+01	·	6.9e+01	+	6.1e+01	+
	(4.0e+00)	(5.2e+00)		(7.2e+00)		(4.8e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.0e−02)	(6.1e−02)		(4.6e−02)		(5.5e−02)	
f_9	3.8e+01	3.8e+01	·	3.7e+01	·	3.7e+01	·
	(1.3e+00)	(1.1e+00)		(1.7e+00)		(1.2e+00)	
f_{10}	6.6e+01	6.5e+01	·	1.7e+02	+	7.5e+01	+
	(1.1e+01)	(1.4e+01)		(3.7e+01)		(1.1e+01)	
f_{11}	7.1e+01	5.7e+01	−	2.7e+01	−	7.5e+01	·
	(5.4e+00)	(4.4e+00)		(5.2e+00)		(6.5e+00)	
f_{12}	2.0e+02	2.0e+02	·	2.2e+02	+	1.9e+02	−
	(1.2e+01)	(1.0e+01)		(1.4e+01)		(1.1e+01)	
f_{13}	2.0e+02	1.9e+02	·	2.2e+02	+	2.0e+02	·
	(1.0e+01)	(1.0e+01)		(1.0e+01)		(9.8e+00)	
f_{14}	3.2e+03	2.4e+03	−	9.0e+02	−	3.6e+03	+
	(2.1e+02)	(2.3e+02)		(2.8e+02)		(2.2e+02)	
f_{15}	7.3e+03	7.3e+03	·	7.3e+03	·	7.3e+03	·
	(2.8e+02)	(2.3e+02)		(2.4e+02)		(2.5e+02)	
f_{16}	2.4e+00	2.4e+00	·	2.5e+00	·	2.5e+00	·
	(2.5e−01)	(2.7e−01)		(3.3e−01)		(2.7e−01)	
f_{17}	1.0e+02	9.4e+01	−	8.7e+01	−	1.1e+02	·
	(5.3e+00)	(5.0e+00)		(8.2e+00)		(6.4e+00)	
f_{18}	2.3e+02	2.3e+02	·	2.5e+02	+	2.2e+02	·
	(7.5e+00)	(9.8e+00)		(1.2e+01)		(1.1e+01)	
f_{19}	1.0e+01	1.0e+01	·	1.3e+01	+	1.0e+01	·
	(6.4e−01)	(7.3e−01)		(9.3e−01)		(7.0e−01)	
f_{20}	1.3e+01	1.3e+01	·	1.3e+01	−	1.4e+01	+
	(2.5e−01)	(3.0e−01)		(2.5e−01)		(2.2e−01)	
f_{21}	3.0e+02	2.6e+02	−	3.1e+02	·	5.4e+02	+
	(7.7e+00)	(3.6e+01)		(8.1e+01)		(7.5e+01)	
f_{22}	3.9e+03	3.4e+03	−	1.4e+03	−	4.0e+03	·
	(2.2e+02)	(2.7e+02)		(3.4e+02)		(2.5e+02)	
f_{23}	7.6e+03	7.6e+03	·	7.5e+03	·	7.7e+03	·
	(2.5e+02)	(2.7e+02)		(2.7e+02)		(2.4e+02)	
f_{24}	2.8e+02	2.8e+02	+	2.8e+02	+	2.7e+02	−
	(3.9e+00)	(3.8e+00)		(5.3e+00)		(3.1e+00)	
f_{25}	3.0e+02	3.0e+02	·	3.0e+02	−	3.1e+02	+
	(2.8e+00)	(2.2e+00)		(5.4e+00)		(2.7e+00)	
f_{26}	2.1e+02	2.1e+02	·	2.1e+02	−	2.1e+02	·
	(2.2e+00)	(2.5e+00)		(1.1e+00)		(2.7e+00)	
f_{27}	1.2e+03	1.2e+03	·	1.2e+03	·	1.2e+03	−
	(3.6e+01)	(3.7e+01)		(3.5e+01)		(3.8e+01)	
f_{28}	3.0e+02	3.0e+02	+	3.0e+02	+	3.0e+02	−
	(1.4e−05)	(1.3e−05)		(4.7e−02)		(3.8e+00)	
Summary (+/·/−)		3/20/5		11/8/9		8/16/4	

Table 126: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	2.3e+07	7.1e+07	+	6.4e+07	+	6.6e+07	+
	(3.7e+06)	(1.2e+07)		(1.0e+07)		(1.4e+07)	
f_3	2.2e+06	2.5e+07	+	4.6e+08	+	1.3e+09	+
	(3.4e+06)	(1.6e+07)		(2.3e+08)		(4.4e+08)	
f_4	3.5e+04	6.2e+04	+	3.7e+04	·	3.9e+04	·
	(4.9e+03)	(9.1e+03)		(5.7e+03)		(5.5e+03)	
f_5	0.0e+00	0.0e+00	·	2.0e−09	·	1.3e−08	+
	(0.0e+00)	(0.0e+00)		(4.8e−09)		(8.5e−09)	
f_6	3.9e+01	5.8e+01	+	2.3e+01	−	3.4e+01	·
	(1.9e+01)	(8.7e+00)		(9.4e+00)		(1.2e+01)	
f_7	1.0e+01	3.0e+01	+	5.2e+01	+	5.6e+01	+
	(2.0e+00)	(8.3e+00)		(7.7e+00)		(5.8e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.5e−02)	(4.3e−02)		(5.5e−02)		(4.7e−02)	
f_9	3.5e+01	3.7e+01	+	3.7e+01	+	3.7e+01	+
	(1.4e+00)	(1.2e+00)		(9.8e−01)		(1.5e+00)	
f_{10}	1.8e−01	2.0e+00	+	3.0e+01	+	6.7e+01	+
	(2.3e−01)	(1.1e+00)		(1.1e+01)		(1.4e+01)	
f_{11}	4.5e+01	0.0e+00	−	1.9e+01	−	8.8e+01	+
	(3.6e+00)	(0.0e+00)		(9.6e+00)		(6.4e+00)	
f_{12}	1.7e+02	1.7e+02	·	2.0e+02	+	2.0e+02	+
	(9.7e+00)	(8.1e+00)		(1.1e+01)		(1.0e+01)	
f_{13}	1.7e+02	1.7e+02	·	2.0e+02	+	2.0e+02	+
	(1.0e+01)	(1.1e+01)		(1.3e+01)		(1.1e+01)	
f_{14}	3.3e+03	4.4e+02	−	6.8e+02	−	3.5e+03	·
	(2.3e+02)	(6.4e+01)		(3.0e+02)		(2.1e+02)	
f_{15}	7.2e+03	7.2e+03	·	7.3e+03	·	7.2e+03	·
	(2.1e+02)	(3.0e+02)		(3.5e+02)		(2.4e+02)	
f_{16}	2.4e+00	2.5e+00	·	2.4e+00	·	2.5e+00	·
	(3.0e−01)	(3.0e−01)		(2.6e−01)		(2.8e−01)	
f_{17}	7.5e+01	6.8e+01	−	7.4e+01	·	1.2e+02	+
	(4.3e+00)	(3.0e+00)		(6.4e+00)		(7.9e+00)	
f_{18}	2.0e+02	2.0e+02	·	2.3e+02	+	2.4e+02	+
	(8.7e+00)	(8.3e+00)		(1.2e+01)		(1.1e+01)	
f_{19}	7.9e+00	6.6e+00	−	1.1e+01	+	1.1e+01	+
	(5.4e−01)	(8.0e−01)		(1.2e+00)		(7.8e−01)	
f_{20}	1.3e+01	1.3e+01	·	1.3e+01	·	1.3e+01	·
	(1.8e−01)	(2.2e−01)		(2.6e−01)		(2.1e−01)	
f_{21}	3.0e+02	2.8e+02	·	3.0e+02	+	2.9e+02	·
	(6.8e+01)	(3.8e+01)		(8.1e+01)		(7.6e+01)	
f_{22}	3.3e+03	1.4e+03	−	9.5e+02	−	3.7e+03	+
	(2.5e+02)	(3.8e+02)		(4.9e+02)		(2.5e+02)	
f_{23}	7.4e+03	7.5e+03	·	7.4e+03	·	7.4e+03	·
	(2.7e+02)	(3.2e+02)		(3.3e+02)		(3.2e+02)	
f_{24}	2.0e+02	2.3e+02	+	2.7e+02	+	2.7e+02	+
	(1.5e+00)	(1.7e+01)		(8.9e+00)		(7.4e+00)	
f_{25}	2.9e+02	3.0e+02	+	2.9e+02	·	2.9e+02	·
	(1.5e+01)	(2.9e+00)		(8.0e+00)		(6.5e+00)	
f_{26}	2.0e+02	2.1e+02	+	2.1e+02	+	2.1e+02	+
	(3.5e−01)	(1.9e+00)		(1.1e+00)		(8.7e−01)	
f_{27}	7.8e+02	1.2e+03	+	1.2e+03	+	1.2e+03	+
	(9.5e+01)	(4.0e+01)		(5.2e+01)		(4.7e+01)	
f_{28}	3.0e+02	3.1e+02	+	3.5e+02	+	3.0e+02	+
	(2.9e−13)	(2.5e+01)		(2.3e+02)		(1.9e−05)	
Summary (+/·/−)		12/11/5		14/10/4		17/11/0	

Table 127: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	1.3e−03	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(6.5e−04)		(0.0e+00)	
f_2	1.3e+08	1.2e+08	·	9.9e+07	−	1.1e+08	−
	(2.1e+07)	(2.3e+07)		(2.3e+07)		(1.7e+07)	
f_3	8.6e+07	9.0e+07	·	2.7e+09	+	2.8e+08	+
	(2.7e+07)	(2.8e+07)		(8.9e+08)		(5.7e+07)	
f_4	6.3e+04	6.1e+04	·	3.9e+04	−	6.1e+04	·
	(7.9e+03)	(8.1e+03)		(5.9e+03)		(6.3e+03)	
f_5	3.2e−06	3.2e−06	·	4.2e−02	+	1.4e−07	−
	(5.6e−07)	(6.2e−07)		(1.2e−02)		(2.4e−08)	
f_6	3.2e+01	3.2e+01	·	3.4e+01	·	2.7e+01	·
	(6.1e+00)	(5.8e+00)		(1.4e+01)		(5.8e+00)	
f_7	4.0e+01	4.1e+01	·	7.0e+01	+	4.8e+01	+
	(3.9e+00)	(3.7e+00)		(1.1e+01)		(4.3e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.9e−02)	(5.7e−02)		(4.8e−02)		(4.8e−02)	
f_9	3.9e+01	3.9e+01	·	3.9e+01	·	3.9e+01	·
	(9.4e−01)	(1.1e+00)		(1.2e+00)		(1.2e+00)	
f_{10}	5.6e+01	5.7e+01	·	1.4e+02	+	7.5e+01	+
	(1.1e+01)	(1.1e+01)		(4.8e+01)		(1.2e+01)	
f_{11}	9.0e+01	9.2e+01	·	1.6e+01	−	1.2e+02	+
	(7.0e+00)	(7.1e+00)		(3.3e+00)		(7.2e+00)	
f_{12}	2.0e+02	2.0e+02	·	2.3e+02	+	2.0e+02	·
	(9.8e+00)	(1.1e+01)		(1.3e+01)		(8.9e+00)	
f_{13}	2.0e+02	2.0e+02	·	2.3e+02	+	2.0e+02	·
	(9.9e+00)	(1.2e+01)		(1.3e+01)		(1.0e+01)	
f_{14}	3.6e+03	3.7e+03	·	3.5e+02	−	5.0e+03	+
	(2.6e+02)	(2.6e+02)		(1.5e+02)		(2.7e+02)	
f_{15}	7.2e+03	7.3e+03	·	7.2e+03	·	7.3e+03	·
	(2.5e+02)	(2.3e+02)		(3.0e+02)		(2.5e+02)	
f_{16}	2.5e+00	2.5e+00	·	2.5e+00	·	2.5e+00	·
	(2.3e−01)	(2.4e−01)		(3.4e−01)		(2.3e−01)	
f_{17}	1.2e+02	1.3e+02	·	5.9e+01	−	1.6e+02	+
	(1.1e+01)	(9.3e+00)		(9.2e+00)		(6.6e+00)	
f_{18}	2.3e+02	2.3e+02	·	2.6e+02	+	2.3e+02	·
	(1.1e+01)	(1.1e+01)		(1.6e+01)		(1.1e+01)	
f_{19}	1.4e+01	1.4e+01	·	1.3e+01	·	1.4e+01	·
	(8.9e−01)	(1.1e+00)		(2.1e+00)		(9.5e−01)	
f_{20}	1.3e+01	1.3e+01	·	1.3e+01	·	1.3e+01	·
	(1.9e−01)	(2.0e−01)		(2.0e−01)		(2.0e−01)	
f_{21}	2.6e+02	2.6e+02	·	3.2e+02	+	5.0e+02	+
	(3.5e+01)	(3.5e+01)		(7.6e+01)		(1.2e+02)	
f_{22}	4.2e+03	4.3e+03	·	4.1e+02	−	5.3e+03	+
	(4.3e+02)	(3.0e+02)		(1.2e+02)		(2.9e+02)	
f_{23}	7.6e+03	7.4e+03	·	7.4e+03	·	7.5e+03	·
	(2.9e+02)	(3.5e+02)		(3.4e+02)		(3.4e+02)	
f_{24}	2.6e+02	2.6e+02	·	2.8e+02	+	2.6e+02	·
	(6.4e+00)	(6.2e+00)		(1.1e+01)		(3.5e+00)	
f_{25}	3.1e+02	3.1e+02	·	2.9e+02	−	3.1e+02	+
	(3.3e+00)	(3.4e+00)		(1.6e+01)		(2.9e+00)	
f_{26}	2.1e+02	2.1e+02	·	2.2e+02	·	2.1e+02	·
	(1.6e+00)	(2.0e+00)		(4.3e+01)		(2.0e+00)	
f_{27}	1.3e+03	1.3e+03	·	1.2e+03	·	1.2e+03	−
	(3.1e+01)	(3.3e+01)		(5.8e+01)		(3.9e+01)	
f_{28}	3.0e+02	3.0e+02	·	3.0e+02	+	3.0e+02	−
	(3.4e−04)	(2.5e−04)		(7.7e−01)		(5.6e−05)	
Summary (+/·/−)		0/28/0		11/10/7		9/15/4	

Table 128: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.3e−01	8.4e−02	−	3.2e+00	+	4.8e−02	−
	(1.9e−02)	(1.6e−02)		(1.0e+00)		(6.7e−03)	
f_2	1.4e+08	1.5e+08	·	1.3e+08	·	1.4e+08	·
	(2.6e+07)	(2.7e+07)		(2.5e+07)		(2.2e+07)	
f_3	4.1e+09	3.6e+09	−	6.4e+09	+	4.9e+09	+
	(5.5e+08)	(4.9e+08)		(1.7e+09)		(7.2e+08)	
f_4	6.4e+04	6.8e+04	·	4.8e+04	−	6.5e+04	·
	(8.6e+03)	(7.7e+03)		(6.4e+03)		(7.8e+03)	
f_5	6.2e−01	4.7e−01	−	4.0e+00	+	2.5e−01	−
	(6.4e−02)	(5.5e−02)		(9.8e−01)		(2.3e−02)	
f_6	8.0e+01	6.7e+01	−	6.2e+01	−	9.4e+01	+
	(8.0e+00)	(6.6e+00)		(1.5e+01)		(7.3e+00)	
f_7	8.2e+01	7.9e+01	·	8.9e+01	+	8.5e+01	·
	(6.7e+00)	(6.2e+00)		(9.9e+00)		(6.0e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.1e−02)	(4.9e−02)		(5.3e−02)		(5.8e−02)	
f_9	3.9e+01	3.9e+01	·	3.9e+01	·	3.9e+01	·
	(1.0e+00)	(1.2e+00)		(1.3e+00)		(1.5e+00)	
f_{10}	4.2e+02	3.7e+02	−	3.0e+02	−	4.2e+02	·
	(6.0e+01)	(5.8e+01)		(9.4e+01)		(5.4e+01)	
f_{11}	1.4e+02	1.2e+02	−	8.4e+00	−	1.4e+02	·
	(8.2e+00)	(9.0e+00)		(3.1e+00)		(1.1e+01)	
f_{12}	2.3e+02	2.3e+02	·	2.5e+02	+	2.3e+02	·
	(1.3e+01)	(1.0e+01)		(1.2e+01)		(1.1e+01)	
f_{13}	2.3e+02	2.3e+02	·	2.5e+02	+	2.3e+02	·
	(1.1e+01)	(1.1e+01)		(1.7e+01)		(1.0e+01)	
f_{14}	5.1e+03	3.9e+03	−	1.4e+02	−	5.2e+03	·
	(2.5e+02)	(2.8e+02)		(5.2e+01)		(2.7e+02)	
f_{15}	7.3e+03	7.3e+03	·	7.3e+03	·	7.4e+03	·
	(2.6e+02)	(2.3e+02)		(2.4e+02)		(2.5e+02)	
f_{16}	2.5e+00	2.5e+00	·	2.4e+00	·	2.5e+00	·
	(2.5e−01)	(3.2e−01)		(3.2e−01)		(2.5e−01)	
f_{17}	1.9e+02	1.7e+02	−	5.3e+01	−	1.9e+02	·
	(8.9e+00)	(1.1e+01)		(7.2e+00)		(8.2e+00)	
f_{18}	2.7e+02	2.7e+02	·	2.9e+02	+	2.7e+02	·
	(1.1e+01)	(9.8e+00)		(1.7e+01)		(9.8e+00)	
f_{19}	1.8e+01	1.8e+01	·	1.6e+01	−	1.8e+01	·
	(1.2e+00)	(1.1e+00)		(2.6e+00)		(1.2e+00)	
f_{20}	1.3e+01	1.3e+01	·	1.3e+01	·	1.3e+01	+
	(2.0e−01)	(2.3e−01)		(2.4e−01)		(2.1e−01)	
f_{21}	6.5e+02	5.0e+02	·	3.5e+02	−	8.9e+02	+
	(1.7e+02)	(1.3e+02)		(6.4e+01)		(1.6e+02)	
f_{22}	5.5e+03	4.5e+03	−	2.7e+02	−	5.6e+03	·
	(2.7e+02)	(2.9e+02)		(7.1e+01)		(2.6e+02)	
f_{23}	7.6e+03	7.7e+03	·	7.5e+03	·	7.7e+03	·
	(3.2e+02)	(3.0e+02)		(3.1e+02)		(3.0e+02)	
f_{24}	2.9e+02	2.9e+02	·	2.9e+02	·	2.9e+02	·
	(3.7e+00)	(3.5e+00)		(6.5e+00)		(3.6e+00)	
f_{25}	3.1e+02	3.1e+02	·	3.0e+02	−	3.2e+02	+
	(3.1e+00)	(3.2e+00)		(8.3e+00)		(3.3e+00)	
f_{26}	2.1e+02	2.1e+02	·	2.1e+02	−	2.1e+02	·
	(2.6e+00)	(2.5e+00)		(2.2e+00)		(2.9e+00)	
f_{27}	1.3e+03	1.3e+03	·	1.3e+03	·	1.3e+03	·
	(2.5e+01)	(3.5e+01)		(3.2e+01)		(4.1e+01)	
f_{28}	3.3e+02	3.3e+02	−	4.3e+02	+	3.3e+02	−
	(3.1e+00)	(2.9e+00)		(2.8e+01)		(1.9e+00)	
Summary (+/·/−)		0/18/10		8/9/11		5/20/3	

Table 129: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	5.6e+03	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(5.7e+02)		(0.0e+00)		(0.0e+00)	
f_2	1.1e+07	1.7e+08	+	1.1e+07	·	1.7e+07	+
	(5.3e+06)	(2.4e+07)		(4.6e+06)		(5.5e+06)	
f_3	1.1e+08	2.8e+10	+	8.6e+07	·	5.8e+07	·
	(4.8e+08)	(4.0e+09)		(2.1e+08)		(1.2e+08)	
f_4	1.5e+04	6.6e+04	+	1.4e+04	·	1.5e+04	·
	(3.5e+03)	(7.1e+03)		(2.7e+03)		(3.0e+03)	
f_5	0.0e+00	9.9e+02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.2e+02)		(0.0e+00)		(0.0e+00)	
f_6	3.9e+01	4.6e+02	+	3.8e+01	·	2.9e+01	·
	(2.3e+01)	(6.5e+01)		(2.5e+01)		(1.9e+01)	
f_7	2.6e+01	1.5e+02	+	3.1e+01	·	3.0e+01	·
	(1.8e+01)	(1.2e+01)		(1.7e+01)		(1.6e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.6e−02)	(5.2e−02)		(5.3e−02)		(6.9e−02)	
f_9	1.2e+01	3.9e+01	+	1.6e+01	·	2.7e+01	+
	(4.9e+00)	(1.2e+00)		(9.1e+00)		(6.0e+00)	
f_{10}	3.8e−02	1.1e+03	+	3.3e−02	·	4.3e−01	·
	(3.3e−02)	(1.3e+02)		(1.7e−02)		(4.6e−01)	
f_{11}	2.9e+01	2.3e+02	+	2.6e+01	·	4.8e+01	·
	(1.0e+01)	(1.6e+01)		(9.8e+00)		(2.9e+01)	
f_{12}	1.7e+02	3.2e+02	+	1.8e+02	·	1.8e+02	·
	(1.5e+01)	(1.6e+01)		(1.2e+01)		(1.3e+01)	
f_{13}	1.8e+02	3.2e+02	+	1.8e+02	·	1.8e+02	·
	(1.6e+01)	(1.8e+01)		(1.4e+01)		(1.4e+01)	
f_{14}	7.7e+02	3.9e+03	+	7.7e+02	·	4.6e+03	+
	(3.0e+02)	(2.5e+02)		(2.5e+02)		(4.1e+02)	
f_{15}	7.2e+03	7.3e+03	·	7.2e+03	·	7.2e+03	·
	(3.6e+02)	(3.4e+02)		(3.4e+02)		(3.0e+02)	
f_{16}	2.5e+00	2.5e+00	·	2.5e+00	·	2.5e+00	·
	(3.0e−01)	(2.9e−01)		(2.6e−01)		(3.5e−01)	
f_{17}	5.0e+01	5.0e+02	+	4.8e+01	·	1.4e+02	+
	(6.0e+00)	(3.5e+01)		(8.8e+00)		(9.4e+00)	
f_{18}	2.1e+02	5.4e+02	+	2.1e+02	·	2.1e+02	·
	(1.5e+01)	(2.6e+01)		(1.4e+01)		(1.4e+01)	
f_{19}	7.2e+00	7.9e+02	+	7.3e+00	·	1.1e+01	+
	(2.5e+00)	(2.2e+02)		(2.6e+00)		(1.1e+00)	
f_{20}	1.2e+01	1.3e+01	+	1.2e+01	·	1.2e+01	·
	(4.0e−01)	(1.6e−01)		(3.5e−01)		(3.9e−01)	
f_{21}	2.8e+02	1.8e+03	+	3.0e+02	·	3.1e+02	+
	(6.2e+01)	(9.0e+01)		(7.1e+01)		(7.5e+01)	
f_{22}	8.4e+02	4.6e+03	+	7.4e+02	·	4.3e+03	+
	(2.8e+02)	(3.4e+02)		(2.6e+02)		(5.6e+02)	
f_{23}	7.3e+03	7.6e+03	+	7.2e+03	·	7.2e+03	·
	(3.4e+02)	(3.5e+02)		(3.4e+02)		(3.8e+02)	
f_{24}	2.4e+02	3.0e+02	+	2.3e+02	·	2.3e+02	·
	(1.0e+01)	(4.6e+00)		(1.1e+01)		(1.1e+01)	
f_{25}	2.6e+02	3.2e+02	+	2.6e+02	·	2.5e+02	·
	(7.9e+00)	(2.7e+00)		(7.5e+00)		(7.4e+00)	
f_{26}	2.4e+02	2.2e+02	+	2.3e+02	·	2.4e+02	+
	(5.8e+01)	(4.0e+00)		(5.3e+01)		(6.2e+01)	
f_{27}	6.2e+02	1.3e+03	+	6.3e+02	·	6.7e+02	·
	(6.5e+01)	(3.1e+01)		(8.3e+01)		(1.3e+02)	
f_{28}	3.6e+02	2.3e+03	+	3.2e+02	·	3.6e+02	+
	(2.6e+02)	(7.7e+01)		(1.5e+02)		(2.5e+02)	
Summary (+/·/−)		25/3/0		0/28/0		9/19/0	

Table 130: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	2.1e+02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(6.7e+01)		(0.0e+00)		(0.0e+00)	
f_2	6.3e+07	5.5e+07	·	5.8e+07	·	5.9e+07	·
	(1.3e+07)	(1.5e+07)		(1.0e+07)		(1.6e+07)	
f_3	3.4e+08	2.0e+09	+	8.9e+07	−	5.7e+08	+
	(4.2e+08)	(1.1e+09)		(8.3e+07)		(4.7e+08)	
f_4	2.9e+04	5.6e+04	+	2.8e+04	·	2.9e+04	·
	(5.2e+03)	(9.3e+03)		(5.2e+03)		(4.6e+03)	
f_5	0.0e+00	1.1e+02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(6.1e+01)		(0.0e+00)		(0.0e+00)	
f_6	1.9e+01	9.3e+01	+	2.0e+01	·	2.3e+01	+
	(3.5e+00)	(1.5e+01)		(1.3e+01)		(9.8e+00)	
f_7	4.7e+01	3.7e+01	−	3.8e+01	−	4.9e+01	·
	(1.2e+01)	(7.8e+00)		(1.1e+01)		(1.0e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.3e−02)	(5.2e−02)		(5.9e−02)		(5.7e−02)	
f_9	3.8e+01	3.9e+01	+	3.7e+01	·	3.8e+01	·
	(1.7e+00)	(1.3e+00)		(4.9e+00)		(1.4e+00)	
f_{10}	8.9e+00	3.9e+01	+	2.1e+00	−	1.8e+01	+
	(4.3e+00)	(1.6e+01)		(7.2e−01)		(9.4e+00)	
f_{11}	1.2e+02	4.2e+01	−	1.9e+01	−	1.3e+02	+
	(1.0e+01)	(7.6e+00)		(5.0e+00)		(8.0e+00)	
f_{12}	2.0e+02	1.6e+02	−	2.0e+02	·	2.0e+02	·
	(1.3e+01)	(9.5e+00)		(1.2e+01)		(1.4e+01)	
f_{13}	2.0e+02	1.6e+02	−	2.0e+02	·	2.0e+02	·
	(1.2e+01)	(9.1e+00)		(1.1e+01)		(1.2e+01)	
f_{14}	4.8e+03	2.0e+02	−	5.8e+02	−	5.0e+03	·
	(3.9e+02)	(5.5e+01)		(2.5e+02)		(3.2e+02)	
f_{15}	7.3e+03	7.2e+03	·	7.3e+03	·	7.3e+03	·
	(2.4e+02)	(2.3e+02)		(2.6e+02)		(2.7e+02)	
f_{16}	2.4e+00	2.4e+00	·	2.5e+00	·	2.4e+00	·
	(2.9e−01)	(2.5e−01)		(2.8e−01)		(3.2e−01)	
f_{17}	1.6e+02	1.0e+02	−	5.1e+01	−	1.6e+02	+
	(1.3e+01)	(1.2e+01)		(7.9e+00)		(1.0e+01)	
f_{18}	2.4e+02	2.0e+02	−	2.3e+02	·	2.4e+02	·
	(1.2e+01)	(1.0e+01)		(9.7e+00)		(1.4e+01)	
f_{19}	1.4e+01	1.1e+01	−	1.1e+01	−	1.4e+01	·
	(1.2e+00)	(2.4e+00)		(2.1e+00)		(1.2e+00)	
f_{20}	1.3e+01	1.2e+01	−	1.2e+01	·	1.3e+01	·
	(2.3e−01)	(2.0e−01)		(3.3e−01)		(2.6e−01)	
f_{21}	3.1e+02	7.3e+02	+	3.0e+02	−	3.0e+02	·
	(7.3e+01)	(1.4e+02)		(8.3e+01)		(7.8e+01)	
f_{22}	4.9e+03	4.1e+02	−	5.7e+02	−	5.1e+03	·
	(3.5e+02)	(8.9e+01)		(1.9e+02)		(3.1e+02)	
f_{23}	7.4e+03	7.4e+03	·	7.3e+03	·	7.4e+03	·
	(3.2e+02)	(2.8e+02)		(3.9e+02)		(3.1e+02)	
f_{24}	2.6e+02	2.4e+02	−	2.5e+02	·	2.6e+02	·
	(1.5e+01)	(4.7e+00)		(1.7e+01)		(1.3e+01)	
f_{25}	2.7e+02	2.7e+02	·	2.6e+02	·	2.7e+02	·
	(1.3e+01)	(5.3e+00)		(1.0e+01)		(1.4e+01)	
f_{26}	2.4e+02	2.0e+02	−	2.4e+02	·	2.4e+02	·
	(6.8e+01)	(9.7e−01)		(6.8e+01)		(7.2e+01)	
f_{27}	1.1e+03	6.7e+02	−	9.9e+02	·	1.2e+03	·
	(1.2e+02)	(9.8e+01)		(2.1e+02)		(7.6e+01)	
f_{28}	3.0e+02	8.6e+02	+	3.0e+02	−	3.0e+02	·
	(2.4e−06)	(7.8e+01)		(1.0e−06)		(2.4e−06)	
Summary (+/·/−)		9/6/13		0/18/10		5/23/0	

Table 131: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	2.1e+02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(8.1e+01)		(0.0e+00)		(0.0e+00)	
f_2	2.7e+07	5.2e+07	+	5.8e+07	+	4.1e+07	+
	(3.3e+06)	(1.3e+07)		(1.6e+07)		(4.9e+06)	
f_3	3.4e+06	1.9e+09	+	2.3e+08	+	4.1e+06	·
	(1.8e+06)	(7.8e+08)		(8.8e+08)		(2.5e+06)	
f_4	4.4e+04	5.7e+04	+	2.9e+04	−	4.5e+04	·
	(5.7e+03)	(8.9e+03)		(4.5e+03)		(4.9e+03)	
f_5	5.0e−01	1.0e+02	+	0.0e+00	−	0.0e+00	−
	(5.7e−01)	(4.1e+01)		(0.0e+00)		(0.0e+00)	
f_6	4.0e+01	9.2e+01	+	2.3e+01	−	4.8e+01	·
	(1.8e+01)	(1.5e+01)		(1.5e+01)		(1.4e+01)	
f_7	7.3e+00	3.6e+01	+	4.0e+01	+	3.0e+00	−
	(1.6e+00)	(7.2e+00)		(1.2e+01)		(1.2e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.7e−02)	(5.8e−02)		(6.0e−02)		(5.1e−02)	
f_9	3.7e+01	3.9e+01	+	3.7e+01	·	3.8e+01	+
	(1.2e+00)	(1.3e+00)		(3.9e+00)		(1.4e+00)	
f_{10}	1.9e+00	4.4e+01	+	2.2e+00	·	4.3e−01	−
	(7.6e−01)	(1.5e+01)		(1.1e+00)		(3.1e−01)	
f_{11}	9.4e+01	4.0e+01	−	1.9e+01	−	9.3e+01	·
	(7.7e+00)	(6.5e+00)		(5.0e+00)		(6.2e+00)	
f_{12}	1.8e+02	1.6e+02	−	2.0e+02	+	1.6e+02	−
	(7.2e+00)	(8.2e+00)		(1.3e+01)		(8.0e+00)	
f_{13}	1.8e+02	1.6e+02	−	2.0e+02	+	1.6e+02	−
	(9.3e+00)	(9.3e+00)		(1.1e+01)		(9.6e+00)	
f_{14}	5.1e+03	2.1e+02	−	5.1e+02	−	4.8e+03	−
	(2.2e+02)	(6.5e+01)		(2.2e+02)		(2.7e+02)	
f_{15}	7.1e+03	7.2e+03	·	7.1e+03	·	7.1e+03	·
	(3.1e+02)	(1.9e+02)		(3.6e+02)		(2.2e+02)	
f_{16}	2.5e+00	2.4e+00	·	2.4e+00	·	2.5e+00	·
	(2.9e−01)	(2.4e−01)		(2.7e−01)		(2.5e−01)	
f_{17}	1.2e+02	1.0e+02	−	5.2e+01	−	1.2e+02	·
	(7.7e+00)	(1.2e+01)		(5.6e+00)		(5.7e+00)	
f_{18}	2.0e+02	1.9e+02	·	2.3e+02	+	1.9e+02	−
	(1.1e+01)	(1.0e+01)		(1.1e+01)		(8.4e+00)	
f_{19}	1.1e+01	1.1e+01	·	1.1e+01	·	1.0e+01	·
	(8.9e−01)	(2.1e+00)		(1.8e+00)		(7.7e−01)	
f_{20}	1.3e+01	1.2e+01	−	1.3e+01	−	1.2e+01	−
	(2.4e−01)	(2.4e−01)		(2.4e−01)		(2.4e−01)	
f_{21}	3.0e+02	7.1e+02	+	2.9e+02	·	3.1e+02	·
	(2.0e+01)	(1.4e+02)		(8.3e+01)		(3.9e+01)	
f_{22}	5.1e+03	3.9e+02	−	5.1e+02	−	4.7e+03	−
	(2.0e+02)	(8.0e+01)		(2.1e+02)		(2.3e+02)	
f_{23}	7.5e+03	7.4e+03	·	7.4e+03	·	7.4e+03	·
	(2.9e+02)	(2.9e+02)		(3.4e+02)		(2.9e+02)	
f_{24}	2.0e+02	2.4e+02	+	2.4e+02	+	2.0e+02	−
	(5.1e−01)	(5.0e+00)		(1.9e+01)		(2.2e−01)	
f_{25}	3.0e+02	2.7e+02	−	2.6e+02	−	2.9e+02	·
	(9.5e+00)	(3.7e+00)		(9.2e+00)		(1.1e+01)	
f_{26}	2.0e+02	2.0e+02	·	2.3e+02	+	2.1e+02	+
	(2.2e−01)	(9.5e−01)		(6.2e+01)		(1.5e+01)	
f_{27}	3.6e+02	7.1e+02	+	1.0e+03	+	3.1e+02	−
	(2.2e+01)	(1.4e+02)		(1.5e+02)		(3.1e+00)	
f_{28}	3.0e+02	8.7e+02	+	3.2e+02	+	3.0e+02	+
	(6.2e−02)	(9.7e+01)		(1.6e+02)		(2.0e−13)	
Summary (+/·/−)		13/7/8		10/9/9		4/13/11	

Table 132: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	2.1e+03	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(2.7e+02)		(0.0e+00)		(0.0e+00)	
f_2	6.8e+06	1.2e+08	+	3.1e+07	+	2.8e+07	+
	(2.3e+06)	(2.1e+07)		(9.8e+06)		(7.0e+06)	
f_3	4.4e+06	1.0e+10	+	4.0e+07	·	9.7e+06	·
	(6.4e+06)	(1.4e+09)		(1.2e+08)		(2.2e+07)	
f_4	1.6e+04	5.9e+04	+	2.3e+04	+	2.0e+04	+
	(3.1e+03)	(7.4e+03)		(3.3e+03)		(3.5e+03)	
f_5	3.6e−04	4.0e+02	+	0.0e+00	−	0.0e+00	−
	(8.3e−04)	(4.1e+01)		(0.0e+00)		(0.0e+00)	
f_6	5.1e+01	2.4e+02	+	2.1e+01	−	2.3e+01	−
	(2.5e+01)	(1.9e+01)		(1.3e+01)		(1.5e+01)	
f_7	9.0e+00	9.5e+01	+	2.5e+01	+	1.3e+01	·
	(9.4e+00)	(7.5e+00)		(1.6e+01)		(9.5e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.1e−02)	(4.4e−02)		(5.7e−02)		(4.4e−02)	
f_9	3.2e+01	3.9e+01	+	2.9e+01	·	3.6e+01	+
	(5.3e+00)	(1.2e+00)		(9.6e+00)		(2.7e+00)	
f_{10}	1.4e+00	5.5e+02	+	1.7e−02	−	8.5e−02	−
	(1.4e+00)	(8.4e+01)		(1.2e−02)		(1.9e−01)	
f_{11}	8.7e+01	1.5e+02	+	2.0e+01	−	1.0e+02	+
	(9.4e+00)	(1.2e+01)		(6.0e+00)		(8.2e+00)	
f_{12}	1.7e+02	2.5e+02	+	1.9e+02	+	1.7e+02	·
	(9.8e+00)	(1.9e+01)		(1.3e+01)		(8.6e+00)	
f_{13}	1.7e+02	2.5e+02	+	1.9e+02	+	1.7e+02	·
	(1.1e+01)	(1.2e+01)		(1.1e+01)		(9.1e+00)	
f_{14}	4.7e+03	3.6e+03	−	6.5e+02	−	4.7e+03	·
	(3.0e+02)	(2.9e+02)		(2.3e+02)		(3.0e+02)	
f_{15}	7.1e+03	7.2e+03	·	7.3e+03	·	7.1e+03	·
	(3.0e+02)	(2.7e+02)		(2.7e+02)		(2.9e+02)	
f_{16}	2.5e+00	2.4e+00	·	2.5e+00	·	2.5e+00	·
	(2.9e−01)	(3.6e−01)		(2.8e−01)		(2.4e−01)	
f_{17}	1.2e+02	3.1e+02	+	4.6e+01	−	1.4e+02	+
	(7.8e+00)	(1.9e+01)		(9.4e+00)		(8.4e+00)	
f_{18}	2.0e+02	3.8e+02	+	2.1e+02	+	2.1e+02	·
	(1.0e+01)	(1.6e+01)		(1.4e+01)		(1.1e+01)	
f_{19}	1.1e+01	8.5e+01	+	1.0e+01	·	1.1e+01	+
	(8.6e−01)	(1.9e+01)		(2.0e+00)		(1.0e+00)	
f_{20}	1.2e+01	1.3e+01	+	1.2e+01	·	1.2e+01	·
	(2.8e−01)	(1.9e−01)		(2.7e−01)		(3.1e−01)	
f_{21}	3.1e+02	1.2e+03	+	2.9e+02	·	2.9e+02	·
	(7.9e+01)	(7.0e+01)		(8.2e+01)		(7.6e+01)	
f_{22}	4.6e+03	4.1e+03	−	6.6e+02	−	4.8e+03	·
	(3.1e+02)	(3.9e+02)		(2.6e+02)		(2.9e+02)	
f_{23}	7.2e+03	7.5e+03	+	7.2e+03	·	7.1e+03	·
	(3.3e+02)	(3.1e+02)		(4.2e+02)		(3.2e+02)	
f_{24}	2.1e+02	2.9e+02	+	2.3e+02	+	2.1e+02	·
	(8.7e+00)	(4.0e+00)		(1.1e+01)		(2.0e+01)	
f_{25}	2.5e+02	3.1e+02	+	2.5e+02	·	2.5e+02	·
	(6.3e+00)	(2.8e+00)		(6.6e+00)		(1.0e+01)	
f_{26}	2.0e+02	2.1e+02	+	2.4e+02	+	2.4e+02	+
	(2.3e+01)	(2.3e+00)		(6.3e+01)		(6.0e+01)	
f_{27}	4.4e+02	1.2e+03	+	6.7e+02	+	6.7e+02	+
	(1.2e+02)	(3.8e+01)		(1.6e+02)		(2.2e+02)	
f_{28}	3.2e+02	1.7e+03	+	3.2e+02	+	3.4e+02	+
	(1.4e+02)	(8.0e+01)		(1.5e+02)		(2.0e+02)	
Summary (+/·/−)		23/3/2		10/11/7		9/16/3	

Table 133: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	2.0e−04	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(8.8e−05)		(0.0e+00)	
f_2	1.1e+08	1.2e+08	·	9.5e+07	−	1.0e+08	·
	(1.8e+07)	(1.6e+07)		(2.3e+07)		(1.8e+07)	
f_3	3.4e+07	2.1e+07	−	2.1e+09	+	1.2e+08	+
	(1.8e+07)	(1.0e+07)		(1.0e+09)		(6.3e+07)	
f_4	6.0e+04	6.0e+04	·	3.9e+04	−	5.7e+04	·
	(8.9e+03)	(7.7e+03)		(5.6e+03)		(7.9e+03)	
f_5	8.5e−08	1.8e−07	+	1.6e−02	+	0.0e+00	−
	(1.8e−08)	(3.0e−08)		(4.7e−03)		(0.0e+00)	
f_6	2.8e+01	3.1e+01	·	2.7e+01	·	2.4e+01	−
	(5.4e+00)	(4.9e+00)		(9.8e+00)		(4.2e+00)	
f_7	3.5e+01	3.4e+01	·	6.7e+01	+	4.2e+01	+
	(3.4e+00)	(3.1e+00)		(9.6e+00)		(3.8e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.5e−02)	(4.2e−02)		(5.8e−02)		(4.9e−02)	
f_9	3.9e+01	3.9e+01	·	3.9e+01	·	3.9e+01	·
	(1.4e+00)	(1.2e+00)		(1.3e+00)		(9.0e−01)	
f_{10}	3.7e+01	2.8e+01	−	1.0e+02	+	4.4e+01	+
	(8.7e+00)	(7.5e+00)		(3.3e+01)		(6.8e+00)	
f_{11}	1.2e+02	8.9e+01	−	1.6e+01	−	1.2e+02	·
	(7.2e+00)	(8.0e+00)		(3.8e+00)		(6.1e+00)	
f_{12}	2.0e+02	1.9e+02	·	2.2e+02	+	1.9e+02	·
	(9.2e+00)	(1.0e+01)		(1.1e+01)		(9.0e+00)	
f_{13}	1.9e+02	1.9e+02	·	2.2e+02	+	1.9e+02	·
	(8.6e+00)	(1.2e+01)		(1.4e+01)		(1.0e+01)	
f_{14}	4.8e+03	3.6e+03	−	4.2e+02	−	5.1e+03	+
	(2.2e+02)	(2.9e+02)		(1.6e+02)		(2.0e+02)	
f_{15}	7.2e+03	7.3e+03	·	7.3e+03	·	7.2e+03	·
	(3.2e+02)	(2.5e+02)		(3.4e+02)		(2.8e+02)	
f_{16}	2.5e+00	2.5e+00	·	2.4e+00	·	2.4e+00	·
	(2.5e−01)	(3.1e−01)		(2.7e−01)		(2.9e−01)	
f_{17}	1.5e+02	1.2e+02	−	5.8e+01	−	1.5e+02	·
	(7.4e+00)	(8.3e+00)		(1.1e+01)		(6.4e+00)	
f_{18}	2.2e+02	2.2e+02	·	2.6e+02	+	2.3e+02	·
	(8.6e+00)	(1.1e+01)		(1.1e+01)		(9.3e+00)	
f_{19}	1.4e+01	1.4e+01	·	1.3e+01	·	1.3e+01	·
	(7.1e−01)	(7.1e−01)		(2.1e+00)		(7.4e−01)	
f_{20}	1.3e+01	1.3e+01	·	1.3e+01	·	1.3e+01	+
	(2.3e−01)	(2.6e−01)		(2.5e−01)		(1.9e−01)	
f_{21}	2.9e+02	2.5e+02	−	3.0e+02	+	3.9e+02	+
	(2.5e+01)	(4.2e+01)		(7.3e+01)		(1.2e+02)	
f_{22}	5.2e+03	4.2e+03	−	4.1e+02	−	5.3e+03	·
	(3.2e+02)	(3.5e+02)		(1.3e+02)		(2.8e+02)	
f_{23}	7.5e+03	7.5e+03	·	7.4e+03	·	7.5e+03	·
	(2.9e+02)	(2.7e+02)		(2.7e+02)		(2.8e+02)	
f_{24}	2.4e+02	2.5e+02	+	2.8e+02	+	2.5e+02	+
	(6.1e+00)	(1.0e+01)		(1.0e+01)		(4.8e+00)	
f_{25}	3.1e+02	3.0e+02	·	2.9e+02	−	3.1e+02	+
	(3.0e+00)	(4.4e+00)		(1.3e+01)		(3.1e+00)	
f_{26}	2.1e+02	2.1e+02	·	2.2e+02	·	2.1e+02	·
	(1.7e+00)	(1.6e+00)		(3.6e+01)		(1.8e+00)	
f_{27}	1.2e+03	1.2e+03	·	1.2e+03	·	1.2e+03	−
	(3.7e+01)	(3.7e+01)		(6.5e+01)		(3.2e+01)	
f_{28}	3.0e+02	3.0e+02	+	3.3e+02	+	3.0e+02	−
	(3.1e−05)	(3.0e−05)		(1.9e+02)		(6.2e−06)	
Summary (+/·/−)		3/18/7		11/10/7		8/16/4	

Table 134: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	1.2e+07	6.0e+07	+	5.6e+07	+	6.2e+07	+
	(2.4e+06)	(1.1e+07)		(1.3e+07)		(1.7e+07)	
f_3	3.8e+06	1.2e+08	+	2.5e+08	+	7.1e+08	+
	(3.9e+06)	(1.2e+08)		(6.2e+08)		(4.3e+08)	
f_4	2.2e+04	5.8e+04	+	3.0e+04	+	2.9e+04	+
	(4.0e+03)	(8.2e+03)		(6.1e+03)		(4.3e+03)	
f_5	1.1e−01	3.3e−03	−	5.1e−10	−	2.4e−08	−
	(2.9e−01)	(2.4e−02)		(2.6e−09)		(1.1e−08)	
f_6	5.7e+01	6.3e+01	·	2.2e+01	−	2.8e+01	−
	(2.3e+01)	(1.1e+01)		(1.3e+01)		(1.7e+01)	
f_7	1.0e+00	1.8e+01	+	4.3e+01	+	5.0e+01	+
	(1.0e+00)	(7.9e+00)		(1.1e+01)		(1.0e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.6e−02)	(4.1e−02)		(5.1e−02)		(4.3e−02)	
f_9	3.6e+01	3.8e+01	+	3.8e+01	+	3.8e+01	+
	(1.4e+00)	(1.4e+00)		(1.5e+00)		(1.5e+00)	
f_{10}	2.4e+00	3.6e+00	·	3.0e+00	·	2.8e+01	+
	(2.1e+00)	(1.8e+00)		(1.3e+00)		(1.3e+01)	
f_{11}	8.7e+01	0.0e+00	−	1.9e+01	−	1.3e+02	+
	(7.7e+00)	(0.0e+00)		(6.2e+00)		(8.6e+00)	
f_{12}	1.7e+02	1.6e+02	·	2.1e+02	+	2.0e+02	+
	(7.4e+00)	(9.7e+00)		(8.2e+00)		(1.2e+01)	
f_{13}	1.6e+02	1.6e+02	·	2.0e+02	+	2.0e+02	+
	(7.9e+00)	(1.2e+01)		(1.1e+01)		(1.1e+01)	
f_{14}	4.8e+03	1.0e+03	−	4.9e+02	−	5.0e+03	+
	(2.8e+02)	(2.1e+02)		(1.8e+02)		(2.7e+02)	
f_{15}	7.1e+03	7.3e+03	+	7.3e+03	·	7.3e+03	+
	(2.4e+02)	(2.2e+02)		(2.6e+02)		(2.7e+02)	
f_{16}	2.5e+00	2.5e+00	·	2.4e+00	·	2.5e+00	·
	(2.6e−01)	(2.7e−01)		(3.1e−01)		(3.3e−01)	
f_{17}	1.2e+02	8.4e+01	−	5.0e+01	−	1.7e+02	+
	(8.7e+00)	(5.8e+00)		(7.8e+00)		(1.3e+01)	
f_{18}	1.9e+02	1.9e+02	·	2.3e+02	+	2.4e+02	+
	(1.0e+01)	(8.6e+00)		(1.5e+01)		(1.2e+01)	
f_{19}	1.1e+01	8.1e+00	−	1.1e+01	·	1.5e+01	+
	(7.9e−01)	(1.3e+00)		(1.7e+00)		(1.1e+00)	
f_{20}	1.2e+01	1.2e+01	·	1.3e+01	+	1.3e+01	+
	(2.6e−01)	(1.8e−01)		(2.3e−01)		(2.6e−01)	
f_{21}	3.1e+02	2.7e+02	·	2.8e+02	·	3.0e+02	·
	(6.4e+01)	(5.7e+01)		(7.7e+01)		(7.7e+01)	
f_{22}	4.5e+03	1.1e+03	−	5.7e+02	−	5.1e+03	+
	(3.1e+02)	(4.1e+02)		(2.4e+02)		(2.4e+02)	
f_{23}	7.1e+03	7.3e+03	+	7.3e+03	+	7.3e+03	·
	(2.4e+02)	(3.4e+02)		(3.2e+02)		(4.2e+02)	
f_{24}	2.0e+02	2.0e+02	+	2.4e+02	+	2.7e+02	+
	(3.8e+00)	(3.6e+00)		(1.6e+01)		(1.3e+01)	
f_{25}	2.4e+02	2.6e+02	+	2.6e+02	+	2.8e+02	+
	(1.8e+01)	(8.6e+00)		(8.7e+00)		(1.3e+01)	
f_{26}	2.0e+02	2.0e+02	+	2.2e+02	+	2.2e+02	+
	(1.5e−01)	(9.9e−01)		(5.4e+01)		(4.9e+01)	
f_{27}	3.2e+02	4.0e+02	+	1.0e+03	+	1.2e+03	+
	(1.1e+02)	(1.8e+02)		(1.8e+02)		(8.3e+01)	
f_{28}	3.0e+02	3.3e+02	·	3.0e+02	+	3.0e+02	+
	(2.8e−13)	(5.3e+01)		(3.4e−06)		(1.5e−05)	
Summary (+/·/−)		11/11/6		15/7/6		21/5/2	

Table 135: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	8.0e−08	7.6e−08	·	5.6e−04	+	0.0e+00	−
	(2.7e−08)	(2.3e−08)		(3.7e−04)		(0.0e+00)	
f_2	9.5e+07	9.5e+07	·	5.6e+07	−	8.4e+07	·
	(1.8e+07)	(1.7e+07)		(1.9e+07)		(1.6e+07)	
f_3	2.7e+07	2.9e+07	·	7.9e+08	+	1.6e+08	+
	(1.1e+07)	(1.5e+07)		(8.5e+08)		(4.2e+07)	
f_4	5.8e+04	5.6e+04	·	3.5e+04	−	5.4e+04	·
	(8.7e+03)	(7.9e+03)		(6.9e+03)		(6.5e+03)	
f_5	5.6e−05	5.9e−05	·	1.4e−02	+	3.6e−06	−
	(1.2e−05)	(1.1e−05)		(6.0e−03)		(5.2e−07)	
f_6	1.7e+01	1.7e+01	·	2.0e+01	+	1.6e+01	−
	(2.5e−01)	(6.6e−01)		(5.0e+00)		(2.5e−01)	
f_7	2.9e+01	3.0e+01	·	5.5e+01	+	4.0e+01	+
	(3.3e+00)	(3.4e+00)		(1.2e+01)		(3.9e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.0e−02)	(4.8e−02)		(6.1e−02)		(5.7e−02)	
f_9	3.9e+01	3.9e+01	·	3.7e+01	·	3.9e+01	·
	(1.0e+00)	(1.2e+00)		(2.7e+00)		(1.2e+00)	
f_{10}	1.7e+01	1.7e+01	·	8.4e+00	−	4.7e+01	+
	(4.2e+00)	(4.6e+00)		(4.2e+00)		(7.2e+00)	
f_{11}	1.2e+02	1.2e+02	·	3.1e+01	−	1.5e+02	+
	(8.5e+00)	(1.1e+01)		(8.4e+00)		(6.3e+00)	
f_{12}	2.0e+02	2.0e+02	·	2.3e+02	+	2.0e+02	·
	(1.2e+01)	(9.1e+00)		(1.6e+01)		(1.1e+01)	
f_{13}	2.0e+02	2.0e+02	·	2.3e+02	+	2.0e+02	·
	(1.1e+01)	(9.8e+00)		(1.5e+01)		(8.8e+00)	
f_{14}	4.4e+03	4.4e+03	·	7.9e+02	−	6.1e+03	+
	(3.3e+02)	(2.9e+02)		(2.7e+02)		(2.4e+02)	
f_{15}	7.2e+03	7.2e+03	·	7.3e+03	·	7.2e+03	·
	(3.2e+02)	(3.0e+02)		(2.6e+02)		(2.8e+02)	
f_{16}	2.5e+00	2.5e+00	·	2.4e+00	·	2.5e+00	·
	(3.1e−01)	(2.7e−01)		(2.2e−01)		(2.8e−01)	
f_{17}	1.6e+02	1.6e+02	·	6.4e+01	−	1.9e+02	+
	(1.2e+01)	(9.7e+00)		(9.3e+00)		(1.1e+01)	
f_{18}	2.3e+02	2.3e+02	·	2.6e+02	+	2.3e+02	·
	(1.1e+01)	(1.0e+01)		(1.3e+01)		(1.1e+01)	
f_{19}	1.5e+01	1.6e+01	·	3.2e+00	−	1.6e+01	·
	(1.1e+00)	(9.6e−01)		(6.3e−01)		(1.1e+00)	
f_{20}	1.3e+01	1.3e+01	·	1.3e+01	+	1.3e+01	·
	(2.1e−01)	(1.9e−01)		(2.0e−01)		(2.1e−01)	
f_{21}	2.7e+02	2.7e+02	·	3.1e+02	+	3.9e+02	·
	(4.0e+01)	(4.0e+01)		(7.5e+01)		(1.4e+02)	
f_{22}	4.8e+03	4.8e+03	·	8.0e+02	−	6.2e+03	+
	(3.8e+02)	(2.7e+02)		(2.2e+02)		(2.8e+02)	
f_{23}	7.3e+03	7.4e+03	·	7.5e+03	·	7.3e+03	·
	(2.8e+02)	(3.5e+02)		(2.2e+02)		(2.7e+02)	
f_{24}	2.3e+02	2.3e+02	·	2.6e+02	+	2.5e+02	+
	(4.0e+00)	(5.2e+00)		(1.3e+01)		(3.3e+00)	
f_{25}	2.9e+02	2.9e+02	·	2.7e+02	−	3.1e+02	+
	(1.5e+01)	(1.5e+01)		(1.3e+01)		(3.3e+00)	
f_{26}	2.1e+02	2.1e+02	·	2.2e+02	−	2.1e+02	·
	(1.4e+00)	(1.3e+00)		(4.9e+01)		(1.3e+00)	
f_{27}	1.2e+03	1.2e+03	·	1.1e+03	·	1.2e+03	·
	(6.9e+01)	(5.7e+01)		(1.7e+02)		(3.6e+01)	
f_{28}	3.0e+02	3.0e+02	·	3.0e+02	+	3.0e+02	−
	(3.3e−03)	(2.8e−03)		(4.5e−01)		(4.7e−04)	
Summary (+/·/−)		0/28/0		12/6/10		9/15/4	

Table 136: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.6e+01	4.1e+00	−	2.2e−01	−	7.7e+00	−
	(2.9e+00)	(8.7e−01)		(1.4e−01)		(1.1e+00)	
f_2	1.5e+08	1.4e+08	·	7.8e+07	−	1.4e+08	·
	(2.3e+07)	(2.4e+07)		(3.0e+07)		(2.5e+07)	
f_3	5.8e+09	3.9e+09	−	2.9e+09	−	6.3e+09	·
	(7.6e+08)	(5.4e+08)		(1.5e+09)		(9.2e+08)	
f_4	6.4e+04	6.4e+04	·	4.5e+04	−	6.1e+04	·
	(8.8e+03)	(9.5e+03)		(7.2e+03)		(6.6e+03)	
f_5	8.3e+00	3.5e+00	−	1.0e+00	−	4.8e+00	−
	(9.6e−01)	(5.1e−01)		(4.4e−01)		(4.4e−01)	
f_6	1.0e+02	7.3e+01	−	4.2e+01	−	1.1e+02	·
	(8.7e+00)	(5.7e+00)		(2.1e+01)		(1.0e+01)	
f_7	8.4e+01	7.8e+01	−	7.6e+01	·	8.8e+01	·
	(6.3e+00)	(5.9e+00)		(1.5e+01)		(6.7e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.5e−02)	(6.2e−02)		(4.4e−02)		(5.3e−02)	
f_9	3.9e+01	3.9e+01	·	3.9e+01	·	4.0e+01	·
	(1.1e+00)	(1.2e+00)		(2.2e+00)		(1.1e+00)	
f_{10}	4.8e+02	2.9e+02	−	2.8e+01	−	4.8e+02	·
	(5.5e+01)	(4.1e+01)		(1.8e+01)		(5.4e+01)	
f_{11}	1.9e+02	1.5e+02	−	1.1e+01	−	1.9e+02	·
	(1.0e+01)	(1.0e+01)		(2.8e+00)		(1.1e+01)	
f_{12}	2.4e+02	2.3e+02	−	2.4e+02	·	2.4e+02	·
	(1.3e+01)	(1.1e+01)		(1.9e+01)		(1.1e+01)	
f_{13}	2.4e+02	2.3e+02	−	2.4e+02	·	2.4e+02	·
	(1.3e+01)	(1.4e+01)		(1.8e+01)		(1.4e+01)	
f_{14}	6.2e+03	4.5e+03	−	3.1e+02	−	6.2e+03	·
	(2.2e+02)	(3.3e+02)		(1.4e+02)		(2.5e+02)	
f_{15}	7.3e+03	7.3e+03	·	7.3e+03	·	7.3e+03	·
	(2.9e+02)	(2.8e+02)		(3.2e+02)		(3.0e+02)	
f_{16}	2.4e+00	2.5e+00	·	2.5e+00	·	2.5e+00	·
	(2.5e−01)	(2.5e−01)		(3.0e−01)		(2.7e−01)	
f_{17}	2.5e+02	2.1e+02	−	4.7e+01	−	2.5e+02	·
	(1.1e+01)	(1.4e+01)		(1.1e+01)		(1.0e+01)	
f_{18}	2.9e+02	2.7e+02	−	2.8e+02	−	2.9e+02	·
	(1.3e+01)	(1.3e+01)		(1.6e+01)		(1.4e+01)	
f_{19}	2.3e+01	1.9e+01	−	3.9e+00	−	2.2e+01	·
	(1.5e+00)	(1.2e+00)		(6.8e−01)		(1.5e+00)	
f_{20}	1.3e+01	1.3e+01	·	1.3e+01	·	1.3e+01	·
	(1.7e−01)	(2.4e−01)		(2.2e−01)		(2.2e−01)	
f_{21}	7.2e+02	5.1e+02	−	3.0e+02	−	8.9e+02	·
	(2.6e+02)	(1.9e+02)		(6.3e+01)		(3.2e+02)	
f_{22}	6.4e+03	5.0e+03	−	4.0e+02	−	6.3e+03	·
	(2.6e+02)	(3.4e+02)		(1.4e+02)		(3.4e+02)	
f_{23}	7.5e+03	7.5e+03	·	7.6e+03	·	7.6e+03	·
	(2.7e+02)	(2.5e+02)		(3.3e+02)		(2.7e+02)	
f_{24}	2.9e+02	2.9e+02	−	2.7e+02	−	2.9e+02	·
	(3.1e+00)	(4.5e+00)		(1.4e+01)		(3.5e+00)	
f_{25}	3.1e+02	3.1e+02	·	2.9e+02	−	3.2e+02	+
	(3.1e+00)	(2.6e+00)		(1.6e+01)		(3.4e+00)	
f_{26}	2.1e+02	2.1e+02	·	2.1e+02	−	2.1e+02	·
	(2.2e+00)	(2.0e+00)		(2.6e+00)		(2.5e+00)	
f_{27}	1.3e+03	1.3e+03	·	1.2e+03	·	1.3e+03	·
	(3.3e+01)	(3.3e+01)		(9.7e+01)		(3.0e+01)	
f_{28}	5.6e+02	4.3e+02	−	3.3e+02	−	5.0e+02	−
	(1.9e+01)	(1.4e+01)		(1.0e+01)		(1.3e+01)	
Summary (+/·/−)		0/11/17		0/10/18		1/24/3	

Table 137: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.3e−04	8.5e+03	+	3.6e−03	·	7.3e−08	·
	(5.0e−04)	(9.8e+02)		(2.5e−02)		(4.6e−07)	
f_2	2.5e+06	2.0e+08	+	2.2e+06	·	3.9e+06	+
	(1.3e+06)	(4.2e+07)		(1.4e+06)		(1.8e+06)	
f_3	5.7e+07	4.4e+10	+	5.5e+07	·	9.2e+07	·
	(9.4e+07)	(6.7e+09)		(1.1e+08)		(2.1e+08)	
f_4	5.8e+03	6.5e+04	+	5.8e+03	·	6.6e+03	·
	(1.4e+03)	(8.0e+03)		(1.6e+03)		(1.1e+03)	
f_5	6.7e+00	1.7e+03	+	6.4e+00	·	4.6e+00	·
	(1.0e+01)	(2.5e+02)		(1.1e+01)		(5.6e+00)	
f_6	6.2e+01	7.0e+02	+	7.2e+01	·	6.0e+01	·
	(2.9e+01)	(1.3e+02)		(3.1e+01)		(2.8e+01)	
f_7	6.5e+01	1.8e+02	+	5.9e+01	·	5.7e+01	·
	(3.1e+01)	(1.6e+01)		(3.0e+01)		(3.4e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.2e−02)	(5.2e−02)		(4.5e−02)		(6.0e−02)	
f_9	1.5e+01	3.9e+01	+	1.5e+01	·	1.1e+01	−
	(2.9e+00)	(9.8e−01)		(3.2e+00)		(2.5e+00)	
f_{10}	2.4e+01	1.7e+03	+	1.9e+01	·	5.4e+00	−
	(2.7e+01)	(2.3e+02)		(1.7e+01)		(7.3e+00)	
f_{11}	7.1e+01	2.9e+02	+	6.6e+01	·	5.3e+01	−
	(2.8e+01)	(2.1e+01)		(2.1e+01)		(1.9e+01)	
f_{12}	7.3e+01	3.6e+02	+	7.2e+01	·	1.7e+02	+
	(2.2e+01)	(2.1e+01)		(2.4e+01)		(4.8e+01)	
f_{13}	1.5e+02	3.6e+02	+	1.5e+02	·	1.8e+02	+
	(3.0e+01)	(2.7e+01)		(3.8e+01)		(3.1e+01)	
f_{14}	1.5e+03	4.6e+03	+	1.4e+03	·	5.1e+03	+
	(3.6e+02)	(3.1e+02)		(4.0e+02)		(8.1e+02)	
f_{15}	7.1e+03	7.3e+03	·	7.1e+03	·	7.2e+03	·
	(3.9e+02)	(2.6e+02)		(4.0e+02)		(3.4e+02)	
f_{16}	2.4e+00	2.5e+00	·	2.5e+00	·	2.5e+00	·
	(2.7e−01)	(2.8e−01)		(3.0e−01)		(2.8e−01)	
f_{17}	8.7e+01	6.5e+02	+	8.8e+01	·	1.7e+02	+
	(1.9e+01)	(4.6e+01)		(1.7e+01)		(1.5e+01)	
f_{18}	2.2e+02	6.4e+02	+	2.2e+02	·	2.2e+02	·
	(1.9e+01)	(3.8e+01)		(2.0e+01)		(2.0e+01)	
f_{19}	4.8e+00	2.9e+03	+	5.1e+00	·	1.1e+01	+
	(2.6e+00)	(1.0e+03)		(2.2e+00)		(3.3e+00)	
f_{20}	1.2e+01	1.4e+01	+	1.2e+01	·	1.2e+01	·
	(4.6e−01)	(1.8e−01)		(5.1e−01)		(5.3e−01)	
f_{21}	3.1e+02	2.1e+03	+	3.0e+02	·	3.0e+02	·
	(8.9e+01)	(1.2e+02)		(8.1e+01)		(6.7e+01)	
f_{22}	1.6e+03	5.2e+03	+	1.7e+03	·	4.3e+03	+
	(4.7e+02)	(2.9e+02)		(4.1e+02)		(1.6e+03)	
f_{23}	6.9e+03	7.6e+03	+	6.9e+03	·	7.3e+03	·
	(6.9e+02)	(2.6e+02)		(9.1e+02)		(4.8e+02)	
f_{24}	2.5e+02	3.1e+02	+	2.5e+02	·	2.4e+02	·
	(8.9e+00)	(3.8e+00)		(1.1e+01)		(1.1e+01)	
f_{25}	2.7e+02	3.3e+02	+	2.7e+02	·	2.6e+02	·
	(7.5e+00)	(3.1e+00)		(7.8e+00)		(7.1e+00)	
f_{26}	2.5e+02	2.2e+02	·	2.5e+02	·	2.4e+02	·
	(6.9e+01)	(4.9e+00)		(6.7e+01)		(6.3e+01)	
f_{27}	7.4e+02	1.3e+03	+	7.5e+02	·	6.8e+02	−
	(6.8e+01)	(2.7e+01)		(6.5e+01)		(7.9e+01)	
f_{28}	3.9e+02	2.7e+03	+	3.5e+02	·	3.7e+02	−
	(3.1e+02)	(1.1e+02)		(2.2e+02)		(2.8e+02)	
Summary (+/·/−)		24/4/0		0/28/0		7/16/5	

Table 138: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	4.0e+02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.4e+02)		(0.0e+00)		(0.0e+00)	
f_2	3.2e+07	2.9e+07	·	2.1e+07	−	3.5e+07	·
	(9.3e+06)	(1.0e+07)		(9.8e+06)		(1.1e+07)	
f_3	1.1e+08	4.7e+09	+	7.0e+07	·	2.6e+08	+
	(1.7e+08)	(1.7e+09)		(1.8e+08)		(2.8e+08)	
f_4	2.3e+04	4.8e+04	+	2.3e+04	·	2.3e+04	·
	(4.3e+03)	(6.7e+03)		(3.9e+03)		(4.1e+03)	
f_5	0.0e+00	3.1e+02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(2.5e+02)		(0.0e+00)		(0.0e+00)	
f_6	2.2e+01	1.1e+02	+	2.1e+01	·	2.3e+01	·
	(1.7e+01)	(1.9e+01)		(1.5e+01)		(1.7e+01)	
f_7	4.2e+01	5.4e+01	+	3.4e+01	·	4.3e+01	·
	(1.7e+01)	(9.6e+00)		(1.6e+01)		(1.3e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.3e−02)	(3.8e−02)		(4.7e−02)		(5.3e−02)	
f_9	3.2e+01	3.0e+01	−	2.1e+01	−	3.6e+01	·
	(7.7e+00)	(2.3e+00)		(1.0e+01)		(4.5e+00)	
f_{10}	1.1e+00	1.1e+02	+	2.7e−02	−	1.6e+00	+
	(1.2e−01)	(4.8e+01)		(3.7e−02)		(4.2e−01)	
f_{11}	1.6e+02	6.2e+01	−	3.6e+01	−	1.6e+02	+
	(1.2e+01)	(1.3e+01)		(8.4e+00)		(1.3e+01)	
f_{12}	2.0e+02	1.3e+02	−	2.0e+02	·	2.0e+02	·
	(1.4e+01)	(1.3e+01)		(1.5e+01)		(1.4e+01)	
f_{13}	2.0e+02	1.3e+02	−	2.0e+02	·	2.0e+02	·
	(1.5e+01)	(1.6e+01)		(1.8e+01)		(1.5e+01)	
f_{14}	5.8e+03	3.5e+02	−	8.7e+02	−	6.0e+03	·
	(4.4e+02)	(1.2e+02)		(2.9e+02)		(3.1e+02)	
f_{15}	7.3e+03	7.1e+03	−	7.3e+03	·	7.3e+03	·
	(2.7e+02)	(2.4e+02)		(2.4e+02)		(3.4e+02)	
f_{16}	2.5e+00	2.5e+00	·	2.5e+00	·	2.4e+00	·
	(2.8e−01)	(2.8e−01)		(2.5e−01)		(2.7e−01)	
f_{17}	1.9e+02	1.4e+02	−	6.3e+01	−	2.0e+02	·
	(1.6e+01)	(1.7e+01)		(9.8e+00)		(1.2e+01)	
f_{18}	2.4e+02	2.0e+02	−	2.3e+02	·	2.4e+02	·
	(1.6e+01)	(1.4e+01)		(1.6e+01)		(1.8e+01)	
f_{19}	1.6e+01	2.4e+01	+	2.8e+00	−	1.6e+01	·
	(1.4e+00)	(7.6e+00)		(5.5e−01)		(1.2e+00)	
f_{20}	1.3e+01	1.2e+01	−	1.2e+01	·	1.3e+01	·
	(3.1e−01)	(3.6e−01)		(3.0e−01)		(3.0e−01)	
f_{21}	2.9e+02	8.5e+02	+	2.9e+02	−	2.9e+02	+
	(7.5e+01)	(1.5e+02)		(8.3e+01)		(4.8e+01)	
f_{22}	5.8e+03	6.0e+02	−	1.0e+03	−	6.1e+03	+
	(3.9e+02)	(1.8e+02)		(2.9e+02)		(2.9e+02)	
f_{23}	7.3e+03	7.0e+03	−	7.4e+03	·	7.3e+03	·
	(3.0e+02)	(3.4e+02)		(3.2e+02)		(3.0e+02)	
f_{24}	2.4e+02	2.5e+02	+	2.3e+02	·	2.5e+02	+
	(1.5e+01)	(7.0e+00)		(1.2e+01)		(1.4e+01)	
f_{25}	2.5e+02	2.8e+02	+	2.5e+02	·	2.6e+02	·
	(8.3e+00)	(5.0e+00)		(6.9e+00)		(1.2e+01)	
f_{26}	2.5e+02	2.0e+02	−	2.5e+02	−	2.7e+02	·
	(7.1e+01)	(1.1e+00)		(6.4e+01)		(8.3e+01)	
f_{27}	8.5e+02	8.6e+02	·	6.3e+02	−	9.7e+02	·
	(2.0e+02)	(9.5e+01)		(9.5e+01)		(1.6e+02)	
f_{28}	3.2e+02	1.1e+03	+	3.0e+02	−	3.5e+02	+
	(1.6e+02)	(1.4e+02)		(2.8e+01)		(2.3e+02)	
Summary (+/·/−)		12/4/12		0/16/12		7/21/0	

Table 139: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.4e−04	4.1e+02	+	0.0e+00	·	0.0e+00	·
	(9.6e−04)	(1.5e+02)		(0.0e+00)		(0.0e+00)	
f_2	1.1e+07	2.9e+07	+	2.1e+07	+	1.5e+07	+
	(1.8e+06)	(1.1e+07)		(6.6e+06)		(1.9e+06)	
f_3	3.4e+06	5.7e+09	+	8.8e+07	·	3.7e+06	·
	(2.7e+06)	(2.2e+09)		(2.3e+08)		(2.5e+06)	
f_4	3.6e+04	4.7e+04	+	2.3e+04	−	3.5e+04	·
	(4.5e+03)	(6.9e+03)		(4.2e+03)		(4.4e+03)	
f_5	1.3e+01	3.0e+02	+	0.0e+00	−	9.2e−02	−
	(1.3e+01)	(1.9e+02)		(0.0e+00)		(3.2e−01)	
f_6	4.3e+01	1.1e+02	+	1.9e+01	−	4.6e+01	·
	(2.2e+01)	(1.6e+01)		(1.2e+01)		(1.8e+01)	
f_7	7.2e−01	5.4e+01	+	3.4e+01	+	7.0e−01	·
	(5.0e−01)	(9.0e+00)		(1.7e+01)		(5.5e−01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.3e−02)	(5.3e−02)		(4.9e−02)		(4.5e−02)	
f_9	3.8e+01	2.9e+01	−	1.9e+01	−	3.8e+01	·
	(1.2e+00)	(2.1e+00)		(9.0e+00)		(1.2e+00)	
f_{10}	2.3e+00	1.1e+02	+	2.2e−02	−	6.0e−01	−
	(9.2e−01)	(4.4e+01)		(2.5e−02)		(4.7e−01)	
f_{11}	1.2e+02	6.5e+01	−	3.7e+01	−	1.2e+02	·
	(7.4e+00)	(1.1e+01)		(9.1e+00)		(1.1e+01)	
f_{12}	1.7e+02	1.3e+02	−	2.0e+02	+	1.6e+02	−
	(1.0e+01)	(1.4e+01)		(1.5e+01)		(8.8e+00)	
f_{13}	1.7e+02	1.3e+02	−	2.0e+02	+	1.6e+02	−
	(1.2e+01)	(1.5e+01)		(1.4e+01)		(8.7e+00)	
f_{14}	5.9e+03	3.6e+02	−	9.9e+02	−	5.8e+03	·
	(3.2e+02)	(1.2e+02)		(2.7e+02)		(2.5e+02)	
f_{15}	7.1e+03	7.0e+03	·	7.3e+03	·	7.0e+03	·
	(2.6e+02)	(2.6e+02)		(2.9e+02)		(2.9e+02)	
f_{16}	2.5e+00	2.5e+00	·	2.4e+00	·	2.5e+00	·
	(2.4e−01)	(2.7e−01)		(2.8e−01)		(2.7e−01)	
f_{17}	1.5e+02	1.4e+02	−	6.3e+01	−	1.5e+02	·
	(7.6e+00)	(1.7e+01)		(1.1e+01)		(8.0e+00)	
f_{18}	1.9e+02	1.9e+02	·	2.3e+02	+	1.8e+02	·
	(9.3e+00)	(1.2e+01)		(1.6e+01)		(1.1e+01)	
f_{19}	1.3e+01	2.3e+01	+	3.1e+00	−	1.2e+01	−
	(1.2e+00)	(7.4e+00)		(6.8e−01)		(6.9e−01)	
f_{20}	1.2e+01	1.2e+01	−	1.3e+01	+	1.2e+01	−
	(2.3e−01)	(3.5e−01)		(3.4e−01)		(2.8e−01)	
f_{21}	3.2e+02	8.6e+02	+	3.0e+02	·	3.0e+02	·
	(4.7e+01)	(1.9e+02)		(6.2e+01)		(4.9e+01)	
f_{22}	5.9e+03	5.6e+02	−	1.0e+03	−	5.5e+03	−
	(2.9e+02)	(1.5e+02)		(3.3e+02)		(2.2e+02)	
f_{23}	7.3e+03	7.1e+03	·	7.4e+03	·	7.1e+03	·
	(2.9e+02)	(3.1e+02)		(3.4e+02)		(2.3e+02)	
f_{24}	2.0e+02	2.5e+02	+	2.3e+02	+	2.0e+02	−
	(4.7e−01)	(6.2e+00)		(1.2e+01)		(1.0e−01)	
f_{25}	2.1e+02	2.8e+02	+	2.5e+02	+	2.4e+02	+
	(2.2e+01)	(5.4e+00)		(6.3e+00)		(1.8e+01)	
f_{26}	2.0e+02	2.0e+02	+	2.3e+02	+	2.3e+02	+
	(5.6e−02)	(1.3e+00)		(5.3e+01)		(4.3e+01)	
f_{27}	3.1e+02	8.6e+02	+	6.4e+02	+	3.0e+02	−
	(5.3e+00)	(9.1e+01)		(7.6e+01)		(1.6e+00)	
f_{28}	3.1e+02	1.2e+03	+	3.4e+02	−	3.0e+02	−
	(6.1e+00)	(1.1e+02)		(2.1e+02)		(7.2e+00)	
Summary (+/·/−)		15/5/8		10/7/11		3/15/10	

Table 140: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	3.6e+03	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(5.4e+02)		(0.0e+00)		(0.0e+00)	
f_2	8.2e+05	1.3e+08	+	7.3e+06	+	7.9e+06	+
	(4.4e+05)	(2.2e+07)		(3.7e+06)		(3.0e+06)	
f_3	6.8e+06	1.7e+10	+	8.6e+07	·	6.0e+06	−
	(1.4e+07)	(2.2e+09)		(3.9e+08)		(1.7e+07)	
f_4	6.2e+03	6.0e+04	+	1.5e+04	+	1.1e+04	+
	(1.4e+03)	(7.4e+03)		(3.1e+03)		(2.1e+03)	
f_5	9.7e+00	6.9e+02	+	0.0e+00	−	0.0e+00	−
	(1.3e+01)	(1.2e+02)		(0.0e+00)		(0.0e+00)	
f_6	6.7e+01	3.2e+02	+	2.1e+01	−	2.9e+01	−
	(2.3e+01)	(4.2e+01)		(1.6e+01)		(1.7e+01)	
f_7	1.9e+01	1.2e+02	+	3.4e+01	·	1.8e+01	·
	(1.3e+01)	(9.6e+00)		(2.3e+01)		(1.3e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.5e−02)	(5.7e−02)		(5.6e−02)		(5.1e−02)	
f_9	1.0e+01	3.9e+01	+	1.1e+01	·	1.1e+01	·
	(2.5e+00)	(1.1e+00)		(3.3e+00)		(7.6e+00)	
f_{10}	6.7e+00	8.2e+02	+	2.3e−02	−	2.0e−02	−
	(5.6e+00)	(1.0e+02)		(1.6e−02)		(1.5e−02)	
f_{11}	6.1e+01	2.0e+02	+	4.5e+01	·	1.3e+02	+
	(4.0e+01)	(1.4e+01)		(1.2e+01)		(1.0e+01)	
f_{12}	1.7e+02	2.8e+02	+	1.8e+02	·	1.7e+02	·
	(1.7e+01)	(1.5e+01)		(2.6e+01)		(1.1e+01)	
f_{13}	1.7e+02	2.8e+02	+	1.9e+02	+	1.7e+02	·
	(1.5e+01)	(1.5e+01)		(1.7e+01)		(1.2e+01)	
f_{14}	5.6e+03	4.3e+03	−	1.1e+03	−	5.8e+03	·
	(4.4e+02)	(3.1e+02)		(2.9e+02)		(3.3e+02)	
f_{15}	7.0e+03	7.2e+03	·	7.2e+03	·	7.2e+03	·
	(3.5e+02)	(2.7e+02)		(3.4e+02)		(3.0e+02)	
f_{16}	2.5e+00	2.5e+00	·	2.5e+00	·	2.5e+00	·
	(3.0e−01)	(2.8e−01)		(2.3e−01)		(2.4e−01)	
f_{17}	1.6e+02	4.0e+02	+	6.9e+01	−	1.7e+02	+
	(1.3e+01)	(2.3e+01)		(1.1e+01)		(1.2e+01)	
f_{18}	2.0e+02	4.4e+02	+	2.2e+02	+	2.0e+02	+
	(1.0e+01)	(2.3e+01)		(1.5e+01)		(9.5e+00)	
f_{19}	1.2e+01	2.5e+02	+	3.0e+00	−	1.3e+01	+
	(1.4e+00)	(7.8e+01)		(7.6e−01)		(8.6e−01)	
f_{20}	1.2e+01	1.3e+01	+	1.2e+01	·	1.2e+01	·
	(3.6e−01)	(2.6e−01)		(4.0e−01)		(4.8e−01)	
f_{21}	3.0e+02	1.4e+03	+	2.9e+02	·	2.9e+02	+
	(7.1e+01)	(1.3e+02)		(6.5e+01)		(6.9e+01)	
f_{22}	5.5e+03	4.8e+03	−	1.3e+03	−	5.7e+03	·
	(4.1e+02)	(3.5e+02)		(4.7e+02)		(3.9e+02)	
f_{23}	7.1e+03	7.4e+03	+	7.2e+03	·	7.1e+03	·
	(3.1e+02)	(3.0e+02)		(3.4e+02)		(3.5e+02)	
f_{24}	2.2e+02	3.0e+02	+	2.4e+02	+	2.2e+02	·
	(1.1e+01)	(3.1e+00)		(9.0e+00)		(1.3e+01)	
f_{25}	2.6e+02	3.2e+02	+	2.5e+02	·	2.5e+02	−
	(9.3e+00)	(2.6e+00)		(7.1e+00)		(6.1e+00)	
f_{26}	2.2e+02	2.1e+02	+	2.5e+02	+	2.4e+02	+
	(4.2e+01)	(2.4e+00)		(6.2e+01)		(5.8e+01)	
f_{27}	5.6e+02	1.3e+03	+	6.3e+02	+	5.4e+02	·
	(1.0e+02)	(2.9e+01)		(6.5e+01)		(8.8e+01)	
f_{28}	3.9e+02	2.0e+03	+	3.4e+02	·	3.6e+02	+
	(3.3e+02)	(6.9e+01)		(2.1e+02)		(2.5e+02)	
Summary (+/·/−)		23/3/2		7/14/7		9/14/5	

Table 141: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	7.9e−05	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(5.5e−05)		(0.0e+00)	
f_2	8.4e+07	8.6e+07	·	5.1e+07	−	7.5e+07	·
	(1.3e+07)	(1.6e+07)		(1.8e+07)		(1.5e+07)	
f_3	7.8e+06	3.5e+06	−	5.4e+08	+	2.7e+07	+
	(6.1e+06)	(2.2e+06)		(4.3e+08)		(1.1e+07)	
f_4	5.7e+04	5.8e+04	·	3.5e+04	−	5.1e+04	·
	(7.8e+03)	(7.3e+03)		(6.3e+03)		(7.5e+03)	
f_5	2.5e−06	2.9e−06	·	5.0e−03	+	6.7e−08	−
	(7.1e−07)	(5.4e−07)		(2.5e−03)		(1.1e−08)	
f_6	1.6e+01	1.7e+01	+	2.4e+01	+	1.6e+01	−
	(1.6e−01)	(1.7e−01)		(1.5e+01)		(2.1e−01)	
f_7	2.5e+01	2.2e+01	−	5.8e+01	+	3.2e+01	+
	(3.2e+00)	(2.7e+00)		(1.6e+01)		(3.1e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(6.1e−02)	(4.0e−02)		(6.3e−02)		(5.2e−02)	
f_9	3.9e+01	3.9e+01	·	3.6e+01	−	3.9e+01	·
	(1.3e+00)	(1.2e+00)		(4.3e+00)		(1.4e+00)	
f_{10}	1.7e+01	6.7e+00	−	5.6e+00	−	2.1e+01	+
	(3.9e+00)	(1.5e+00)		(2.6e+00)		(3.9e+00)	
f_{11}	1.5e+02	1.1e+02	−	3.0e+01	−	1.5e+02	·
	(9.9e+00)	(9.5e+00)		(6.2e+00)		(9.8e+00)	
f_{12}	2.0e+02	1.9e+02	·	2.2e+02	+	2.0e+02	·
	(8.9e+00)	(9.9e+00)		(1.4e+01)		(1.1e+01)	
f_{13}	1.9e+02	1.9e+02	·	2.2e+02	+	2.0e+02	·
	(9.8e+00)	(9.4e+00)		(1.8e+01)		(9.7e+00)	
f_{14}	5.9e+03	4.5e+03	−	8.7e+02	−	6.0e+03	·
	(2.7e+02)	(3.1e+02)		(2.9e+02)		(2.5e+02)	
f_{15}	7.3e+03	7.2e+03	·	7.3e+03	·	7.3e+03	·
	(2.4e+02)	(2.9e+02)		(2.6e+02)		(2.2e+02)	
f_{16}	2.5e+00	2.5e+00	·	2.5e+00	·	2.5e+00	·
	(2.3e−01)	(2.7e−01)		(2.2e−01)		(2.6e−01)	
f_{17}	1.8e+02	1.5e+02	−	6.6e+01	−	1.8e+02	·
	(1.1e+01)	(1.1e+01)		(1.0e+01)		(9.3e+00)	
f_{18}	2.3e+02	2.3e+02	·	2.6e+02	+	2.3e+02	·
	(1.0e+01)	(8.5e+00)		(1.6e+01)		(9.7e+00)	
f_{19}	1.6e+01	1.5e+01	·	3.4e+00	−	1.6e+01	·
	(9.4e−01)	(8.7e−01)		(8.0e−01)		(8.2e−01)	
f_{20}	1.2e+01	1.3e+01	·	1.3e+01	+	1.3e+01	·
	(2.0e−01)	(1.6e−01)		(2.4e−01)		(1.9e−01)	
f_{21}	2.7e+02	2.6e+02	·	3.3e+02	+	3.9e+02	·
	(4.5e+01)	(4.5e+01)		(8.0e+01)		(1.4e+02)	
f_{22}	6.0e+03	4.9e+03	−	8.3e+02	−	6.1e+03	·
	(2.7e+02)	(3.9e+02)		(2.7e+02)		(2.6e+02)	
f_{23}	7.3e+03	7.3e+03	·	7.4e+03	·	7.3e+03	·
	(2.4e+02)	(3.1e+02)		(2.4e+02)		(2.8e+02)	
f_{24}	2.2e+02	2.2e+02	−	2.5e+02	+	2.3e+02	+
	(2.3e+00)	(2.5e+00)		(1.1e+01)		(3.2e+00)	
f_{25}	2.9e+02	2.8e+02	·	2.6e+02	−	3.1e+02	+
	(1.7e+01)	(1.8e+01)		(8.2e+00)		(3.9e+00)	
f_{26}	2.1e+02	2.1e+02	·	2.3e+02	−	2.1e+02	·
	(1.0e+00)	(1.3e+00)		(6.5e+01)		(1.1e+00)	
f_{27}	1.1e+03	1.2e+03	·	1.0e+03	·	1.1e+03	·
	(1.2e+02)	(8.0e+01)		(1.9e+02)		(6.4e+01)	
f_{28}	3.0e+02	3.0e+02	·	3.0e+02	+	3.0e+02	−
	(3.9e−04)	(4.2e−04)		(3.0e−01)		(2.8e−05)	
Summary (+/·/−)		1/19/8		12/5/11		5/20/3	

Table 142: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	9.4e−01	1.1e−04	−	0.0e+00	−	0.0e+00	−
	(2.9e+00)	(6.2e−04)		(0.0e+00)		(0.0e+00)	
f_2	1.9e+06	1.3e+07	+	2.3e+07	+	3.8e+07	+
	(6.3e+05)	(6.4e+06)		(1.1e+07)		(9.7e+06)	
f_3	7.5e+07	3.7e+08	+	7.0e+07	·	7.9e+08	+
	(2.0e+08)	(4.2e+08)		(2.0e+08)		(8.9e+08)	
f_4	9.0e+03	4.8e+04	+	2.4e+04	+	2.4e+04	+
	(1.7e+03)	(7.6e+03)		(4.1e+03)		(3.9e+03)	
f_5	7.8e+01	1.4e+00	−	0.0e+00	−	1.4e−08	−
	(6.3e+01)	(6.8e+00)		(0.0e+00)		(1.2e−08)	
f_6	8.2e+01	6.4e+01	−	2.2e+01	−	2.1e+01	−
	(2.2e+01)	(1.3e+01)		(1.7e+01)		(1.3e+01)	
f_7	2.9e+00	1.3e+01	+	3.3e+01	+	5.2e+01	+
	(3.4e+00)	(6.4e+00)		(1.7e+01)		(1.4e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.4e−02)	(4.3e−02)		(4.8e−02)		(5.5e−02)	
f_9	2.7e+01	2.5e+01	·	1.8e+01	·	3.6e+01	+
	(1.2e+01)	(9.5e+00)		(9.5e+00)		(3.4e+00)	
f_{10}	2.5e+01	7.7e+00	−	7.8e−02	−	3.0e+00	−
	(1.9e+01)	(4.6e+00)		(1.8e−01)		(1.3e+00)	
f_{11}	1.2e+02	1.4e−01	−	3.7e+01	−	1.6e+02	+
	(8.1e+00)	(3.5e−01)		(1.1e+01)		(1.2e+01)	
f_{12}	1.6e+02	1.5e+02	−	2.0e+02	+	2.1e+02	+
	(9.3e+00)	(9.9e+00)		(1.2e+01)		(1.6e+01)	
f_{13}	1.6e+02	1.5e+02	−	2.0e+02	+	2.1e+02	+
	(9.6e+00)	(1.2e+01)		(1.4e+01)		(1.5e+01)	
f_{14}	5.8e+03	1.9e+03	−	1.0e+03	−	6.1e+03	+
	(2.7e+02)	(3.5e+02)		(2.7e+02)		(2.8e+02)	
f_{15}	7.0e+03	7.1e+03	·	7.3e+03	+	7.2e+03	+
	(2.7e+02)	(2.8e+02)		(3.0e+02)		(2.9e+02)	
f_{16}	2.5e+00	2.5e+00	·	2.4e+00	·	2.4e+00	·
	(2.4e−01)	(2.8e−01)		(2.7e−01)		(2.5e−01)	
f_{17}	1.5e+02	9.9e+01	−	6.5e+01	−	2.1e+02	+
	(8.6e+00)	(7.1e+00)		(8.4e+00)		(1.2e+01)	
f_{18}	1.9e+02	1.9e+02	·	2.3e+02	+	2.4e+02	+
	(1.1e+01)	(9.0e+00)		(1.6e+01)		(1.5e+01)	
f_{19}	1.1e+01	7.1e+00	−	3.0e+00	−	1.6e+01	+
	(1.8e+00)	(1.8e+00)		(7.1e−01)		(1.0e+00)	
f_{20}	1.1e+01	1.2e+01	+	1.3e+01	+	1.3e+01	+
	(3.2e−01)	(2.5e−01)		(3.7e−01)		(2.6e−01)	
f_{21}	3.3e+02	2.9e+02	·	2.9e+02	·	2.9e+02	·
	(9.1e+01)	(8.1e+01)		(6.3e+01)		(7.1e+01)	
f_{22}	5.4e+03	1.6e+03	−	1.0e+03	−	6.0e+03	+
	(3.4e+02)	(4.3e+02)		(3.0e+02)		(3.2e+02)	
f_{23}	7.0e+03	7.1e+03	·	7.4e+03	+	7.3e+03	+
	(2.8e+02)	(3.5e+02)		(3.3e+02)		(3.3e+02)	
f_{24}	2.1e+02	2.1e+02	·	2.3e+02	+	2.6e+02	+
	(9.8e+00)	(6.5e+00)		(9.5e+00)		(1.8e+01)	
f_{25}	2.5e+02	2.5e+02	·	2.5e+02	·	2.6e+02	+
	(5.8e+00)	(4.9e+00)		(6.7e+00)		(1.0e+01)	
f_{26}	2.1e+02	2.0e+02	+	2.3e+02	+	2.4e+02	+
	(3.0e+01)	(2.6e−01)		(5.7e+01)		(7.3e+01)	
f_{27}	3.7e+02	3.8e+02	·	6.3e+02	+	9.8e+02	+
	(8.5e+01)	(8.1e+01)		(8.2e+01)		(1.6e+02)	
f_{28}	4.0e+02	3.9e+02	·	3.6e+02	−	3.2e+02	−
	(1.6e+02)	(9.1e+01)		(2.5e+02)		(1.6e+02)	
Summary (+/·/−)		6/11/11		12/6/10		20/3/5	

Table 143: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	2.2e−07	2.2e−07	·	5.3e−09	−	3.6e−07	+
	(9.8e−08)	(8.2e−08)		(1.2e−08)		(6.5e−08)	
f_2	5.8e+06	5.9e+06	·	1.3e+06	−	1.0e+07	+
	(1.4e+06)	(1.3e+06)		(7.0e+05)		(2.1e+06)	
f_3	1.5e+06	1.4e+06	·	3.1e+07	+	9.0e+07	+
	(7.6e+05)	(6.3e+05)		(4.7e+07)		(2.1e+07)	
f_4	3.0e+04	3.0e+04	·	9.9e+03	−	3.3e+04	+
	(4.3e+03)	(4.1e+03)		(3.9e+03)		(3.6e+03)	
f_5	3.6e−05	3.9e−05	·	1.1e−05	−	6.7e−05	+
	(9.4e−06)	(1.3e−05)		(7.4e−06)		(1.1e−05)	
f_6	1.4e+01	1.4e+01	·	2.1e+01	·	1.1e+01	−
	(1.8e+00)	(1.8e+00)		(1.4e+01)		(3.0e−01)	
f_7	1.0e+01	9.6e+00	·	2.1e+01	+	3.4e+01	+
	(2.4e+00)	(2.0e+00)		(1.1e+01)		(3.4e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.9e−02)	(5.4e−02)		(5.3e−02)		(4.9e−02)	
f_9	3.9e+01	3.9e+01	·	1.6e+01	−	3.9e+01	·
	(1.3e+00)	(1.4e+00)		(4.8e+00)		(1.2e+00)	
f_{10}	9.6e−01	9.8e−01	·	2.6e−02	−	1.4e+00	+
	(7.0e−02)	(5.1e−02)		(1.5e−02)		(6.2e−02)	
f_{11}	1.4e+02	1.4e+02	·	6.5e+01	−	1.8e+02	+
	(1.3e+01)	(1.1e+01)		(1.6e+01)		(8.9e+00)	
f_{12}	1.9e+02	1.9e+02	·	6.7e+01	−	2.0e+02	+
	(9.6e+00)	(1.1e+01)		(2.2e+01)		(1.3e+01)	
f_{13}	1.9e+02	1.9e+02	·	1.1e+02	−	2.0e+02	+
	(8.7e+00)	(1.2e+01)		(3.2e+01)		(1.0e+01)	
f_{14}	5.2e+03	5.2e+03	·	1.9e+03	−	6.9e+03	+
	(3.4e+02)	(2.7e+02)		(4.1e+02)		(3.1e+02)	
f_{15}	7.2e+03	7.2e+03	·	4.8e+03	−	7.2e+03	·
	(2.7e+02)	(3.1e+02)		(7.7e+02)		(2.7e+02)	
f_{16}	2.4e+00	2.4e+00	·	2.1e+00	·	2.5e+00	·
	(2.8e−01)	(2.6e−01)		(4.4e−01)		(2.7e−01)	
f_{17}	1.8e+02	1.7e+02	·	1.1e+02	−	2.2e+02	+
	(1.0e+01)	(1.0e+01)		(2.3e+01)		(1.1e+01)	
f_{18}	2.2e+02	2.2e+02	·	1.5e+02	−	2.4e+02	+
	(1.0e+01)	(1.0e+01)		(3.0e+01)		(1.1e+01)	
f_{19}	1.5e+01	1.5e+01	·	5.5e+00	−	1.7e+01	+
	(1.1e+00)	(7.9e−01)		(1.2e+00)		(8.7e−01)	
f_{20}	1.2e+01	1.2e+01	·	1.2e+01	−	1.3e+01	·
	(2.3e−01)	(2.7e−01)		(5.5e−01)		(1.9e−01)	
f_{21}	2.8e+02	2.7e+02	·	3.0e+02	·	2.9e+02	·
	(6.8e+01)	(6.6e+01)		(8.3e+01)		(9.5e+01)	
f_{22}	5.5e+03	5.5e+03	·	1.9e+03	−	6.9e+03	+
	(3.5e+02)	(4.0e+02)		(4.6e+02)		(3.0e+02)	
f_{23}	7.1e+03	7.2e+03	·	4.9e+03	−	7.2e+03	·
	(3.4e+02)	(2.7e+02)		(7.8e+02)		(2.6e+02)	
f_{24}	2.1e+02	2.1e+02	·	2.4e+02	+	2.4e+02	+
	(1.6e+00)	(1.7e+00)		(9.4e+00)		(3.6e+00)	
f_{25}	2.6e+02	2.6e+02	·	2.6e+02	·	3.1e+02	+
	(1.1e+01)	(1.1e+01)		(9.0e+00)		(8.9e+00)	
f_{26}	2.0e+02	2.0e+02	·	2.3e+02	−	2.0e+02	+
	(9.2e−02)	(6.7e−02)		(5.8e+01)		(1.3e−01)	
f_{27}	6.3e+02	6.9e+02	·	6.9e+02	+	1.1e+03	+
	(1.9e+02)	(2.3e+02)		(1.1e+02)		(6.9e+01)	
f_{28}	3.0e+02	3.0e+02	·	3.2e+02	−	3.0e+02	+
	(8.3e−03)	(6.7e−03)		(1.5e+02)		(4.4e−03)	
Summary (+/·/−)		0/28/0		4/5/19		20/7/1	

Table 144: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.9e+02	7.7e+00	−	2.5e+02	·	1.8e+02	·
	(3.4e+01)	(1.9e+00)		(1.4e+02)		(2.4e+01)	
f_2	7.3e+07	4.4e+07	−	3.7e+06	−	8.0e+07	·
	(1.5e+07)	(8.9e+06)		(2.9e+06)		(1.3e+07)	
f_3	7.7e+09	2.5e+09	−	9.0e+08	−	9.3e+09	+
	(1.1e+09)	(4.0e+08)		(7.9e+08)		(1.0e+09)	
f_4	6.0e+04	5.5e+04	·	1.9e+04	−	6.0e+04	·
	(7.8e+03)	(7.1e+03)		(7.3e+03)		(6.4e+03)	
f_5	2.8e+01	4.3e+00	−	5.0e+01	·	2.6e+01	−
	(3.0e+00)	(7.5e−01)		(7.3e+01)		(2.3e+00)	
f_6	1.2e+02	4.2e+01	−	6.8e+01	−	1.3e+02	+
	(1.3e+01)	(8.5e+00)		(2.7e+01)		(1.1e+01)	
f_7	9.1e+01	6.5e+01	−	4.4e+01	−	9.7e+01	·
	(6.4e+00)	(5.1e+00)		(2.1e+01)		(7.8e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.3e−02)	(5.4e−02)		(1.0e−01)		(4.4e−02)	
f_9	4.0e+01	3.9e+01	·	2.4e+01	−	4.0e+01	·
	(1.1e+00)	(1.3e+00)		(3.7e+00)		(1.1e+00)	
f_{10}	2.3e+02	4.0e+01	−	6.8e+01	−	2.6e+02	+
	(3.6e+01)	(1.1e+01)		(5.0e+01)		(3.1e+01)	
f_{11}	2.2e+02	1.7e+02	−	7.1e+01	−	2.3e+02	·
	(1.3e+01)	(1.1e+01)		(1.7e+01)		(1.2e+01)	
f_{12}	2.5e+02	2.2e+02	−	1.5e+02	−	2.5e+02	·
	(1.0e+01)	(1.2e+01)		(2.1e+01)		(1.3e+01)	
f_{13}	2.5e+02	2.2e+02	−	1.6e+02	−	2.5e+02	·
	(1.6e+01)	(1.3e+01)		(3.0e+01)		(1.2e+01)	
f_{14}	6.9e+03	5.2e+03	−	1.4e+03	−	6.9e+03	·
	(3.1e+02)	(3.4e+02)		(3.3e+02)		(2.9e+02)	
f_{15}	7.3e+03	7.3e+03	·	5.4e+03	−	7.3e+03	·
	(2.8e+02)	(2.5e+02)		(6.0e+02)		(3.1e+02)	
f_{16}	2.5e+00	2.4e+00	·	1.5e+00	−	2.4e+00	·
	(2.2e−01)	(2.9e−01)		(5.8e−01)		(3.5e−01)	
f_{17}	3.1e+02	2.2e+02	−	1.8e+02	−	3.1e+02	·
	(2.7e+01)	(1.3e+01)		(3.1e+01)		(1.3e+01)	
f_{18}	3.3e+02	2.5e+02	−	2.5e+02	−	3.3e+02	·
	(2.2e+01)	(1.3e+01)		(3.0e+01)		(1.3e+01)	
f_{19}	2.8e+01	1.8e+01	−	1.5e+01	−	3.1e+01	+
	(2.0e+00)	(1.0e+00)		(8.1e+00)		(2.6e+00)	
f_{20}	1.3e+01	1.3e+01	·	1.2e+01	−	1.3e+01	·
	(2.5e−01)	(2.0e−01)		(4.6e−01)		(1.9e−01)	
f_{21}	6.6e+02	3.7e+02	−	5.6e+02	−	8.9e+02	+
	(1.2e+02)	(5.6e+01)		(1.2e+02)		(2.6e+02)	
f_{22}	7.2e+03	5.8e+03	−	1.5e+03	−	7.2e+03	·
	(2.1e+02)	(3.2e+02)		(3.5e+02)		(2.6e+02)	
f_{23}	7.4e+03	7.5e+03	·	5.7e+03	−	7.5e+03	·
	(2.4e+02)	(2.1e+02)		(6.0e+02)		(3.5e+02)	
f_{24}	2.9e+02	2.6e+02	−	2.6e+02	−	3.0e+02	·
	(4.6e+00)	(5.7e+00)		(8.5e+00)		(3.6e+00)	
f_{25}	3.2e+02	3.1e+02	·	2.7e+02	−	3.2e+02	+
	(5.1e+00)	(5.8e+00)		(1.1e+01)		(3.6e+00)	
f_{26}	2.1e+02	2.0e+02	−	2.2e+02	−	2.1e+02	·
	(1.0e+00)	(6.3e−01)		(4.6e+01)		(1.2e+00)	
f_{27}	1.3e+03	1.3e+03	−	8.7e+02	−	1.3e+03	·
	(3.4e+01)	(4.9e+01)		(1.1e+02)		(3.0e+01)	
f_{28}	8.9e+02	4.7e+02	−	7.9e+02	−	9.2e+02	·
	(4.1e+01)	(1.9e+01)		(1.8e+02)		(4.1e+01)	
Summary (+/·/−)		0/8/20		0/3/25		6/21/1	

Table 145: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	9.7e+02	1.1e+04	+	1.1e+03	·	9.7e+02	·
	(6.1e+02)	(1.5e+03)		(6.5e+02)		(6.0e+02)	
f_2	3.2e+06	2.1e+08	+	3.3e+06	·	8.7e+04	−
	(5.4e+06)	(4.3e+07)		(6.5e+06)		(3.8e+04)	
f_3	3.3e+07	5.2e+10	+	6.0e+07	·	2.5e+07	·
	(1.1e+08)	(1.1e+10)		(2.2e+08)		(6.1e+07)	
f_4	5.8e−02	6.9e+04	+	5.2e−02	·	5.9e−02	·
	(5.3e−02)	(9.0e+03)		(5.3e−02)		(7.6e−02)	
f_5	4.5e+02	2.1e+03	+	4.4e+02	·	4.4e+02	·
	(3.3e+02)	(3.1e+02)		(2.2e+02)		(2.3e+02)	
f_6	2.0e+02	9.2e+02	+	2.0e+02	·	1.9e+02	·
	(6.5e+01)	(1.5e+02)		(6.6e+01)		(5.4e+01)	
f_7	1.1e+02	2.1e+02	+	9.7e+01	·	8.6e+01	·
	(3.4e+01)	(2.1e+01)		(2.8e+01)		(3.4e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(6.3e−02)	(6.2e−02)		(4.4e−02)		(5.6e−02)	
f_9	2.1e+01	3.9e+01	+	2.1e+01	·	1.7e+01	−
	(3.3e+00)	(9.2e−01)		(2.5e+00)		(2.5e+00)	
f_{10}	3.8e+02	1.8e+03	+	4.3e+02	·	3.5e+02	·
	(1.8e+02)	(2.5e+02)		(2.0e+02)		(1.9e+02)	
f_{11}	1.5e+02	3.4e+02	+	1.5e+02	·	1.3e+02	·
	(3.2e+01)	(2.6e+01)		(4.2e+01)		(3.3e+01)	
f_{12}	1.5e+02	3.9e+02	+	1.5e+02	·	1.2e+02	−
	(4.4e+01)	(2.4e+01)		(4.0e+01)		(3.0e+01)	
f_{13}	2.4e+02	3.9e+02	+	2.5e+02	·	2.1e+02	·
	(5.5e+01)	(2.2e+01)		(5.6e+01)		(4.9e+01)	
f_{14}	2.8e+03	5.3e+03	+	2.7e+03	·	3.8e+03	·
	(5.1e+02)	(3.5e+02)		(4.7e+02)		(2.2e+03)	
f_{15}	4.0e+03	7.3e+03	+	3.7e+03	·	6.8e+03	+
	(6.3e+02)	(2.6e+02)		(5.4e+02)		(8.4e+02)	
f_{16}	1.5e+00	2.5e+00	+	1.6e+00	·	2.5e+00	+
	(4.6e−01)	(3.0e−01)		(4.2e−01)		(2.7e−01)	
f_{17}	2.1e+02	7.0e+02	+	2.1e+02	·	1.9e+02	·
	(4.3e+01)	(5.1e+01)		(5.5e+01)		(5.4e+01)	
f_{18}	2.2e+02	7.2e+02	+	2.2e+02	·	3.1e+02	+
	(5.0e+01)	(6.1e+01)		(6.2e+01)		(4.5e+01)	
f_{19}	1.0e+02	5.4e+03	+	1.2e+02	·	5.5e+01	·
	(1.4e+02)	(2.5e+03)		(1.6e+02)		(6.3e+01)	
f_{20}	1.2e+01	1.4e+01	+	1.2e+01	·	1.2e+01	·
	(1.0e+00)	(2.2e−01)		(1.3e+00)		(1.0e+00)	
f_{21}	8.1e+02	2.2e+03	+	8.4e+02	·	7.9e+02	·
	(2.6e+02)	(1.5e+02)		(3.4e+02)		(3.1e+02)	
f_{22}	3.2e+03	5.9e+03	+	3.2e+03	·	2.7e+03	−
	(6.2e+02)	(2.9e+02)		(5.4e+02)		(1.2e+03)	
f_{23}	4.4e+03	7.7e+03	+	4.4e+03	·	6.2e+03	+
	(7.9e+02)	(2.3e+02)		(6.9e+02)		(1.9e+03)	
f_{24}	2.7e+02	3.1e+02	+	2.7e+02	·	2.7e+02	−
	(9.5e+00)	(4.1e+00)		(1.1e+01)		(8.6e+00)	
f_{25}	2.9e+02	3.3e+02	+	2.9e+02	·	2.9e+02	·
	(1.0e+01)	(3.9e+00)		(1.1e+01)		(7.9e+00)	
f_{26}	3.0e+02	2.2e+02	·	3.0e+02	·	3.0e+02	·
	(7.5e+01)	(5.0e+00)		(7.7e+01)		(7.1e+01)	
f_{27}	9.2e+02	1.3e+03	+	9.1e+02	·	8.4e+02	−
	(6.7e+01)	(4.0e+01)		(7.8e+01)		(6.1e+01)	
f_{28}	1.3e+03	2.9e+03	+	1.3e+03	·	9.4e+02	·
	(5.8e+02)	(1.8e+02)		(5.2e+02)		(5.5e+02)	
Summary (+/·/−)		26/2/0		0/28/0		4/18/6	

Table 146: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	2.6e+03	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.1e+03)		(0.0e+00)		(0.0e+00)	
f_2	3.3e+05	8.5e+07	+	2.8e+05	·	3.9e+05	·
	(1.5e+05)	(2.4e+07)		(1.5e+05)		(2.2e+05)	
f_3	5.5e+06	2.9e+10	+	6.8e+06	·	9.9e+06	·
	(1.2e+07)	(1.3e+10)		(1.3e+07)		(2.6e+07)	
f_4	2.6e+03	6.5e+04	+	9.4e+02	−	4.2e+03	+
	(1.0e+03)	(1.3e+04)		(4.5e+02)		(1.4e+03)	
f_5	0.0e+00	1.8e+03	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(8.6e+02)		(0.0e+00)		(0.0e+00)	
f_6	8.2e+00	2.6e+02	+	8.2e+00	·	9.7e+00	·
	(9.2e+00)	(6.3e+01)		(9.8e+00)		(1.1e+01)	
f_7	2.8e+01	1.5e+02	+	2.5e+01	·	2.9e+01	·
	(2.6e+01)	(3.3e+01)		(1.5e+01)		(1.4e+01)	
f_8	2.1e+01	2.1e+01	+	2.1e+01	·	2.1e+01	·
	(5.7e−02)	(6.1e−02)		(5.2e−02)		(4.9e−02)	
f_9	1.1e+01	3.4e+01	+	1.2e+01	·	1.6e+01	·
	(6.2e+00)	(1.7e+00)		(3.6e+00)		(1.0e+01)	
f_{10}	7.2e−03	5.9e+02	+	2.1e−02	+	4.0e−03	·
	(9.3e−03)	(2.0e+02)		(1.7e−02)		(6.6e−03)	
f_{11}	1.8e+02	1.8e+02	·	7.7e+01	−	1.9e+02	·
	(1.7e+01)	(4.0e+01)		(2.9e+01)		(1.2e+01)	
f_{12}	2.0e+02	2.6e+02	+	6.9e+01	−	2.1e+02	·
	(1.0e+01)	(2.7e+01)		(1.8e+01)		(1.8e+01)	
f_{13}	2.0e+02	2.6e+02	+	1.2e+02	−	2.1e+02	·
	(1.6e+01)	(3.4e+01)		(3.2e+01)		(1.5e+01)	
f_{14}	6.5e+03	1.2e+03	−	1.9e+03	−	6.8e+03	+
	(5.3e+02)	(2.7e+02)		(4.6e+02)		(3.1e+02)	
f_{15}	7.2e+03	6.9e+03	·	4.2e+03	−	7.3e+03	·
	(3.0e+02)	(3.7e+02)		(7.4e+02)		(2.8e+02)	
f_{16}	2.5e+00	2.7e+00	·	1.8e+00	−	2.5e+00	·
	(3.2e−01)	(3.7e−01)		(5.0e−01)		(2.5e−01)	
f_{17}	2.1e+02	3.0e+02	+	1.1e+02	−	2.2e+02	·
	(1.6e+01)	(4.8e+01)		(2.1e+01)		(1.5e+01)	
f_{18}	2.3e+02	3.5e+02	+	1.4e+02	−	2.4e+02	·
	(1.6e+01)	(3.4e+01)		(2.8e+01)		(1.3e+01)	
f_{19}	1.6e+01	2.9e+03	+	4.5e+00	−	1.6e+01	·
	(1.5e+00)	(4.2e+03)		(1.7e+00)		(1.0e+00)	
f_{20}	1.2e+01	1.4e+01	+	1.1e+01	−	1.2e+01	·
	(3.9e−01)	(4.2e−01)		(8.3e−01)		(3.5e−01)	
f_{21}	2.9e+02	1.4e+03	+	2.9e+02	−	2.9e+02	·
	(7.6e+01)	(2.7e+02)		(7.4e+01)		(9.4e+01)	
f_{22}	6.6e+03	1.9e+03	−	2.1e+03	−	7.0e+03	+
	(4.5e+02)	(5.4e+02)		(4.8e+02)		(3.0e+02)	
f_{23}	7.4e+03	7.3e+03	·	4.2e+03	−	7.4e+03	·
	(3.1e+02)	(4.1e+02)		(7.2e+02)		(3.9e+02)	
f_{24}	2.3e+02	2.9e+02	+	2.4e+02	+	2.3e+02	·
	(1.1e+01)	(7.8e+00)		(9.3e+00)		(9.7e+00)	
f_{25}	2.5e+02	3.0e+02	+	2.6e+02	+	2.5e+02	·
	(7.8e+00)	(7.4e+00)		(8.8e+00)		(7.8e+00)	
f_{26}	2.4e+02	2.1e+02	·	2.6e+02	·	2.5e+02	·
	(5.9e+01)	(2.6e+01)		(6.8e+01)		(6.5e+01)	
f_{27}	5.8e+02	1.2e+03	+	6.7e+02	+	6.0e+02	·
	(6.7e+01)	(5.6e+01)		(7.7e+01)		(7.3e+01)	
f_{28}	3.2e+02	2.1e+03	+	3.0e+02	−	3.0e+02	+
	(1.4e+02)	(2.6e+02)		(1.9e−11)		(2.8e+01)	
Summary (+/·/−)		21/5/2		4/9/15		4/24/0	

Table 147: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	9.8e+01	2.6e+03	+	0.0e+00	−	4.5e−01	−
	(8.1e+01)	(1.0e+03)		(0.0e+00)		(1.1e+00)	
f_2	6.2e+05	8.5e+07	+	3.1e+05	·	6.1e+05	·
	(3.5e+05)	(3.5e+07)		(1.8e+05)		(4.5e+05)	
f_3	2.3e+07	2.8e+10	+	6.5e+06	−	1.7e+07	·
	(2.6e+07)	(1.2e+10)		(1.6e+07)		(1.9e+07)	
f_4	4.0e+03	6.5e+04	+	9.5e+02	−	2.7e+03	·
	(1.7e+03)	(1.2e+04)		(3.6e+02)		(1.4e+03)	
f_5	1.2e+02	2.1e+03	+	0.0e+00	−	4.0e+01	−
	(5.9e+01)	(1.2e+03)		(0.0e+00)		(2.6e+01)	
f_6	6.3e+01	2.8e+02	+	7.6e+00	−	5.5e+01	·
	(1.6e+01)	(1.0e+02)		(9.7e+00)		(1.7e+01)	
f_7	3.3e−01	1.5e+02	+	3.1e+01	+	1.6e−01	·
	(7.5e−01)	(3.2e+01)		(1.9e+01)		(1.8e−01)	
f_8	2.1e+01	2.1e+01	+	2.1e+01	·	2.1e+01	·
	(4.3e−02)	(6.2e−02)		(4.9e−02)		(5.7e−02)	
f_9	3.4e+01	3.4e+01	−	1.3e+01	−	1.8e+01	−
	(6.1e+00)	(2.0e+00)		(3.4e+00)		(1.3e+01)	
f_{10}	1.1e+01	6.5e+02	+	2.0e−02	−	2.6e+00	−
	(7.1e+00)	(2.1e+02)		(1.6e−02)		(1.7e+00)	
f_{11}	1.5e+02	1.7e+02	·	6.6e+01	−	1.4e+02	−
	(1.0e+01)	(3.0e+01)		(2.0e+01)		(1.1e+01)	
f_{12}	1.6e+02	2.5e+02	+	7.0e+01	−	1.6e+02	−
	(1.1e+01)	(3.1e+01)		(2.1e+01)		(9.3e+00)	
f_{13}	1.7e+02	2.6e+02	+	1.3e+02	−	1.6e+02	−
	(7.8e+00)	(2.7e+01)		(3.4e+01)		(8.2e+00)	
f_{14}	6.8e+03	1.2e+03	−	2.0e+03	−	6.6e+03	·
	(2.5e+02)	(2.7e+02)		(4.9e+02)		(2.7e+02)	
f_{15}	7.1e+03	6.9e+03	·	4.2e+03	−	6.9e+03	·
	(2.7e+02)	(3.9e+02)		(6.0e+02)		(2.8e+02)	
f_{16}	2.4e+00	2.8e+00	+	1.9e+00	−	2.5e+00	·
	(2.3e−01)	(3.5e−01)		(4.2e−01)		(2.1e−01)	
f_{17}	1.7e+02	3.0e+02	+	1.2e+02	−	1.7e+02	·
	(9.4e+00)	(5.0e+01)		(2.7e+01)		(7.9e+00)	
f_{18}	1.9e+02	3.4e+02	+	1.3e+02	−	1.8e+02	−
	(9.5e+00)	(4.5e+01)		(2.5e+01)		(7.6e+00)	
f_{19}	1.4e+01	2.6e+03	+	4.7e+00	−	1.1e+01	−
	(2.3e+00)	(2.6e+03)		(1.4e+00)		(1.6e+00)	
f_{20}	1.2e+01	1.4e+01	+	1.2e+01	·	1.1e+01	−
	(2.6e−01)	(4.9e−01)		(5.6e−01)		(2.1e−01)	
f_{21}	3.8e+02	1.4e+03	+	3.0e+02	−	3.2e+02	−
	(7.4e+01)	(2.7e+02)		(9.1e+01)		(7.0e+01)	
f_{22}	6.5e+03	1.9e+03	−	2.2e+03	−	6.2e+03	−
	(2.4e+02)	(6.4e+02)		(6.0e+02)		(2.8e+02)	
f_{23}	7.0e+03	7.2e+03	·	4.2e+03	−	6.8e+03	·
	(2.7e+02)	(5.0e+02)		(7.4e+02)		(2.9e+02)	
f_{24}	2.0e+02	2.9e+02	+	2.4e+02	+	2.0e+02	·
	(8.2e−01)	(6.4e+00)		(1.0e+01)		(4.4e−01)	
f_{25}	2.0e+02	3.1e+02	+	2.6e+02	+	2.0e+02	−
	(6.4e+00)	(6.9e+00)		(9.2e+00)		(9.5e+00)	
f_{26}	2.0e+02	2.2e+02	+	2.8e+02	+	2.2e+02	·
	(7.0e−03)	(3.3e+01)		(6.7e+01)		(4.0e+01)	
f_{27}	3.1e+02	1.2e+03	+	6.5e+02	+	3.0e+02	·
	(1.1e+01)	(5.4e+01)		(8.6e+01)		(4.2e+00)	
f_{28}	4.2e+02	2.1e+03	+	3.6e+02	−	3.6e+02	−
	(4.1e+01)	(2.6e+02)		(2.5e+02)		(4.2e+01)	
Summary (+/·/−)		22/3/3		5/3/20		0/14/14	

Table 148: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	5.4e+01	4.6e+03	+	0.0e+00	−	2.2e−03	−
	(7.4e+01)	(7.1e+02)		(0.0e+00)		(1.6e−02)	
f_2	4.6e+05	1.2e+08	+	1.4e+05	−	9.1e+04	−
	(5.3e+05)	(2.3e+07)		(6.5e+04)		(5.5e+04)	
f_3	5.3e+08	2.3e+10	+	1.1e+07	−	6.8e+05	−
	(4.6e+08)	(3.9e+09)		(3.4e+07)		(2.4e+06)	
f_4	3.0e−01	5.6e+04	+	1.2e+01	+	1.1e+00	+
	(2.6e−01)	(7.5e+03)		(7.8e+00)		(5.1e−01)	
f_5	1.8e+02	8.5e+02	+	1.4e+00	−	2.6e+01	−
	(1.0e+02)	(1.7e+02)		(2.2e+00)		(2.7e+01)	
f_6	1.0e+02	3.8e+02	+	4.7e+01	−	5.6e+01	−
	(2.8e+01)	(6.5e+01)		(2.8e+01)		(2.4e+01)	
f_7	3.9e+01	1.3e+02	+	5.1e+01	·	3.3e+01	·
	(2.4e+01)	(1.4e+01)		(2.7e+01)		(2.5e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.7e−02)	(3.9e−02)		(5.5e−02)		(4.8e−02)	
f_9	1.4e+01	3.8e+01	+	1.5e+01	·	1.1e+01	−
	(2.6e+00)	(1.1e+00)		(3.0e+00)		(2.3e+00)	
f_{10}	5.1e+01	9.2e+02	+	8.6e−01	−	7.1e+00	−
	(4.1e+01)	(1.4e+02)		(2.3e+00)		(8.9e+00)	
f_{11}	5.7e+01	2.3e+02	+	9.3e+01	+	8.1e+01	·
	(1.8e+01)	(1.6e+01)		(2.8e+01)		(5.8e+01)	
f_{12}	6.3e+01	3.0e+02	+	8.9e+01	+	1.8e+02	+
	(2.1e+01)	(1.8e+01)		(2.6e+01)		(2.8e+01)	
f_{13}	1.4e+02	3.0e+02	+	1.6e+02	·	1.8e+02	+
	(4.3e+01)	(1.7e+01)		(3.8e+01)		(1.9e+01)	
f_{14}	6.2e+03	5.1e+03	−	2.1e+03	−	6.6e+03	+
	(5.4e+02)	(2.8e+02)		(4.3e+02)		(4.2e+02)	
f_{15}	6.9e+03	7.1e+03	+	3.9e+03	−	7.1e+03	+
	(4.0e+02)	(3.1e+02)		(5.7e+02)		(3.1e+02)	
f_{16}	2.5e+00	2.5e+00	·	1.7e+00	−	2.5e+00	·
	(2.7e−01)	(2.7e−01)		(3.9e−01)		(2.3e−01)	
f_{17}	1.9e+02	4.4e+02	+	1.1e+02	−	2.0e+02	·
	(1.9e+01)	(3.8e+01)		(2.3e+01)		(1.6e+01)	
f_{18}	2.2e+02	4.5e+02	+	1.2e+02	−	2.1e+02	·
	(1.5e+01)	(4.0e+01)		(2.5e+01)		(1.7e+01)	
f_{19}	1.0e+01	3.8e+02	+	4.8e+00	−	1.3e+01	+
	(5.6e+00)	(1.5e+02)		(1.8e+00)		(2.1e+00)	
f_{20}	1.2e+01	1.3e+01	+	1.1e+01	·	1.2e+01	·
	(4.1e−01)	(2.2e−01)		(1.1e+00)		(4.2e−01)	
f_{21}	4.5e+02	1.4e+03	+	2.9e+02	−	3.1e+02	−
	(1.5e+02)	(1.6e+02)		(8.7e+01)		(8.4e+01)	
f_{22}	6.1e+03	5.6e+03	−	2.4e+03	−	6.4e+03	·
	(5.5e+02)	(3.8e+02)		(5.7e+02)		(4.6e+02)	
f_{23}	6.9e+03	7.4e+03	+	4.4e+03	−	7.1e+03	·
	(5.2e+02)	(3.0e+02)		(7.8e+02)		(4.0e+02)	
f_{24}	2.4e+02	3.0e+02	+	2.5e+02	·	2.4e+02	·
	(1.3e+01)	(4.2e+00)		(8.5e+00)		(1.1e+01)	
f_{25}	2.7e+02	3.2e+02	+	2.7e+02	·	2.6e+02	−
	(7.7e+00)	(3.2e+00)		(7.6e+00)		(8.7e+00)	
f_{26}	2.4e+02	2.1e+02	·	2.8e+02	+	2.6e+02	·
	(6.4e+01)	(2.1e+00)		(7.1e+01)		(6.6e+01)	
f_{27}	6.4e+02	1.3e+03	+	7.6e+02	+	6.3e+02	·
	(7.9e+01)	(3.5e+01)		(7.3e+01)		(8.4e+01)	
f_{28}	5.8e+02	2.2e+03	+	3.9e+02	−	3.5e+02	−
	(2.5e+02)	(9.8e+01)		(3.0e+02)		(2.7e+02)	
Summary (+/·/−)		23/3/2		5/7/16		6/12/10	

Table 149: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	7.9e−08	0.0e+00	−	0.0e+00	−	0.0e+00	−
	(3.7e−08)	(0.0e+00)		(0.0e+00)		(0.0e+00)	
f_2	6.3e+06	3.6e+06	−	1.3e+06	−	6.1e+06	·
	(1.0e+06)	(1.0e+06)		(7.4e+05)		(1.1e+06)	
f_3	1.0e+06	1.1e+05	−	1.9e+07	+	6.5e+06	+
	(4.7e+05)	(8.6e+04)		(2.2e+07)		(2.3e+06)	
f_4	3.0e+04	2.6e+04	·	8.9e+03	−	2.5e+04	−
	(4.9e+03)	(4.9e+03)		(4.0e+03)		(3.5e+03)	
f_5	1.7e−05	1.4e−06	−	2.6e−06	−	9.2e−07	−
	(5.3e−06)	(4.5e−07)		(1.8e−06)		(1.4e−07)	
f_6	1.3e+01	1.4e+01	+	1.6e+01	·	9.6e+00	−
	(2.8e+00)	(3.1e+00)		(9.6e+00)		(1.6e−01)	
f_7	9.8e+00	4.8e+00	−	2.0e+01	+	2.3e+01	+
	(1.9e+00)	(1.5e+00)		(1.2e+01)		(2.5e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.3e−02)	(4.8e−02)		(5.3e−02)		(4.4e−02)	
f_9	3.9e+01	3.9e+01	·	1.6e+01	−	4.0e+01	·
	(1.1e+00)	(1.2e+00)		(4.3e+00)		(1.1e+00)	
f_{10}	1.1e+00	9.3e−02	−	2.1e−02	−	1.0e+00	−
	(2.2e−02)	(8.2e−02)		(1.3e−02)		(8.3e−03)	
f_{11}	1.8e+02	1.3e+02	−	6.3e+01	−	1.8e+02	·
	(9.3e+00)	(9.2e+00)		(1.4e+01)		(1.2e+01)	
f_{12}	1.9e+02	1.8e+02	−	6.9e+01	−	1.9e+02	·
	(8.8e+00)	(1.0e+01)		(2.7e+01)		(1.1e+01)	
f_{13}	1.9e+02	1.8e+02	−	1.1e+02	−	1.9e+02	·
	(1.0e+01)	(7.6e+00)		(2.8e+01)		(1.2e+01)	
f_{14}	6.8e+03	5.2e+03	−	2.0e+03	−	6.9e+03	·
	(2.6e+02)	(3.7e+02)		(4.5e+02)		(2.4e+02)	
f_{15}	7.2e+03	7.3e+03	·	5.0e+03	−	7.2e+03	·
	(3.1e+02)	(2.3e+02)		(6.1e+02)		(2.7e+02)	
f_{16}	2.5e+00	2.5e+00	·	1.9e+00	−	2.4e+00	·
	(2.8e−01)	(2.5e−01)		(4.1e−01)		(2.2e−01)	
f_{17}	2.1e+02	1.7e+02	−	1.1e+02	−	2.1e+02	·
	(1.1e+01)	(9.8e+00)		(2.2e+01)		(8.6e+00)	
f_{18}	2.2e+02	2.2e+02	−	1.5e+02	−	2.3e+02	·
	(9.5e+00)	(9.4e+00)		(2.8e+01)		(1.1e+01)	
f_{19}	1.6e+01	1.5e+01	−	5.5e+00	−	1.7e+01	·
	(1.0e+00)	(9.4e−01)		(1.4e+00)		(7.7e−01)	
f_{20}	1.2e+01	1.2e+01	·	1.2e+01	−	1.2e+01	·
	(1.9e−01)	(2.3e−01)		(6.5e−01)		(1.9e−01)	
f_{21}	2.8e+02	2.7e+02	−	3.1e+02	·	2.6e+02	−
	(7.6e+01)	(7.4e+01)		(7.9e+01)		(6.2e+01)	
f_{22}	6.8e+03	5.4e+03	−	2.0e+03	−	6.8e+03	·
	(2.8e+02)	(3.7e+02)		(4.5e+02)		(3.2e+02)	
f_{23}	7.2e+03	7.2e+03	·	4.9e+03	−	7.2e+03	·
	(2.5e+02)	(2.4e+02)		(9.2e+02)		(3.2e+02)	
f_{24}	2.1e+02	2.0e+02	−	2.4e+02	+	2.2e+02	+
	(1.1e+00)	(8.4e−01)		(1.1e+01)		(2.2e+00)	
f_{25}	2.6e+02	2.5e+02	−	2.5e+02	·	3.0e+02	+
	(9.6e+00)	(8.8e+00)		(7.7e+00)		(1.6e+01)	
f_{26}	2.0e+02	2.0e+02	−	2.4e+02	·	2.0e+02	·
	(7.1e−02)	(4.8e−02)		(6.3e+01)		(8.0e−02)	
f_{27}	5.5e+02	4.8e+02	−	6.8e+02	+	8.1e+02	+
	(9.6e+01)	(1.7e+02)		(8.6e+01)		(8.6e+01)	
f_{28}	3.0e+02	3.0e+02	−	3.6e+02	−	3.0e+02	−
	(3.8e−03)	(6.8e−04)		(2.5e+02)		(1.7e−04)	
Summary (+/·/−)		1/7/20		4/5/19		5/16/7	

Table 150: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.5e+03	3.5e+01	−	0.0e+00	−	0.0e+00	−
	(8.0e+02)	(8.2e+01)		(0.0e+00)		(0.0e+00)	
f_2	2.9e+06	2.0e+07	+	3.1e+05	−	6.1e+05	−
	(2.6e+06)	(9.7e+06)		(1.4e+05)		(3.3e+05)	
f_3	5.1e+09	5.0e+09	·	7.3e+06	−	3.1e+07	−
	(3.7e+09)	(3.1e+09)		(2.6e+07)		(5.0e+07)	
f_4	2.8e+00	2.1e+04	+	1.1e+03	+	6.7e+03	+
	(3.1e+00)	(5.7e+03)		(4.6e+02)		(2.4e+03)	
f_5	5.1e+02	2.2e+02	−	0.0e+00	−	0.0e+00	−
	(2.9e+02)	(2.0e+02)		(0.0e+00)		(0.0e+00)	
f_6	1.8e+02	9.7e+01	−	1.1e+01	−	1.0e+01	−
	(5.0e+01)	(2.2e+01)		(1.0e+01)		(9.4e+00)	
f_7	1.8e+01	4.5e+01	+	2.4e+01	·	3.3e+01	·
	(1.1e+01)	(1.1e+01)		(1.5e+01)		(1.9e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.6e−02)	(5.2e−02)		(4.9e−02)		(4.2e−02)	
f_9	8.8e+00	1.5e+01	+	1.3e+01	+	1.7e+01	+
	(1.5e+00)	(2.1e+00)		(3.2e+00)		(9.6e+00)	
f_{10}	2.6e+02	7.5e+01	−	1.8e−02	−	5.6e−03	−
	(1.5e+02)	(5.5e+01)		(1.4e−02)		(7.7e−03)	
f_{11}	8.6e+01	8.0e+00	−	6.7e+01	·	2.0e+02	+
	(5.5e+01)	(5.2e+00)		(2.0e+01)		(1.3e+01)	
f_{12}	1.6e+02	4.0e+01	−	7.1e+01	−	2.1e+02	+
	(1.5e+01)	(1.1e+01)		(2.0e+01)		(1.1e+01)	
f_{13}	1.7e+02	8.3e+01	−	1.4e+02	−	2.1e+02	+
	(1.3e+01)	(2.4e+01)		(3.0e+01)		(1.2e+01)	
f_{14}	6.5e+03	1.9e+03	−	1.9e+03	−	6.9e+03	+
	(3.3e+02)	(7.8e+02)		(4.7e+02)		(3.4e+02)	
f_{15}	6.8e+03	6.1e+03	−	4.3e+03	−	7.3e+03	+
	(3.3e+02)	(1.3e+03)		(7.6e+02)		(2.9e+02)	
f_{16}	2.5e+00	2.4e+00	·	2.0e+00	−	2.4e+00	·
	(2.7e−01)	(2.8e−01)		(4.6e−01)		(2.6e−01)	
f_{17}	1.8e+02	9.3e+01	−	1.0e+02	−	2.3e+02	+
	(1.4e+01)	(1.3e+01)		(2.2e+01)		(1.4e+01)	
f_{18}	2.0e+02	1.9e+02	−	1.4e+02	−	2.4e+02	+
	(9.0e+00)	(1.1e+01)		(2.8e+01)		(1.7e+01)	
f_{19}	3.3e+01	1.4e+01	−	4.4e+00	−	1.7e+01	·
	(5.1e+01)	(3.5e+01)		(1.6e+00)		(1.3e+00)	
f_{20}	1.1e+01	1.1e+01	·	1.2e+01	·	1.3e+01	+
	(4.0e−01)	(3.9e−01)		(1.1e+00)		(4.2e−01)	
f_{21}	9.3e+02	6.0e+02	−	3.0e+02	−	3.1e+02	−
	(2.5e+02)	(1.8e+02)		(8.7e+01)		(7.5e+01)	
f_{22}	6.1e+03	1.4e+03	−	2.1e+03	−	7.0e+03	+
	(3.7e+02)	(6.2e+02)		(4.6e+02)		(3.2e+02)	
f_{23}	6.8e+03	4.4e+03	−	4.5e+03	−	7.4e+03	+
	(3.0e+02)	(2.0e+03)		(8.3e+02)		(3.3e+02)	
f_{24}	2.4e+02	2.4e+02	·	2.4e+02	·	2.4e+02	·
	(1.1e+01)	(8.6e+00)		(8.9e+00)		(9.0e+00)	
f_{25}	2.6e+02	2.6e+02	·	2.5e+02	−	2.5e+02	−
	(7.2e+00)	(5.8e+00)		(6.0e+00)		(6.2e+00)	
f_{26}	2.3e+02	2.1e+02	+	2.7e+02	·	2.7e+02	·
	(5.2e+01)	(2.7e+01)		(6.8e+01)		(7.0e+01)	
f_{27}	5.8e+02	6.9e+02	+	6.5e+02	+	6.4e+02	+
	(8.0e+01)	(7.3e+01)		(7.0e+01)		(8.3e+01)	
f_{28}	1.3e+03	9.6e+02	−	3.2e+02	−	3.6e+02	−
	(3.2e+02)	(2.5e+02)		(1.4e+02)		(2.5e+02)	
Summary (+/·/−)		6/6/16		3/6/19		13/6/9	

Table 151: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	4.6e−05	6.5e−05	·	1.0e+03	+	1.7e−06	·
	(1.5e−04)	(2.9e−04)		(6.2e+02)		(4.4e−07)	
f_2	1.2e+00	2.9e+00	·	8.2e+05	+	4.0e−02	·
	(3.1e+00)	(8.9e+00)		(1.8e+06)		(1.1e−02)	
f_3	1.0e+06	1.1e+06	·	8.2e+09	+	2.2e+07	+
	(2.3e+06)	(2.0e+06)		(6.4e+09)		(1.1e+07)	
f_4	3.2e−03	2.2e−04	·	2.2e+04	+	4.3e−05	·
	(1.3e−02)	(5.5e−04)		(1.0e+04)		(1.0e−05)	
f_5	9.3e−04	1.3e−03	·	9.9e+01	+	1.1e−04	−
	(1.6e−03)	(4.1e−03)		(3.9e+01)		(2.0e−05)	
f_6	1.9e+01	1.5e+01	·	8.2e+01	+	6.1e−01	−
	(1.9e+01)	(1.4e+01)		(4.4e+01)		(4.5e−01)	
f_7	3.6e+00	3.8e+00	·	8.5e+01	+	2.8e+01	+
	(2.6e+00)	(2.0e+00)		(3.3e+01)		(3.1e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	+	2.1e+01	·
	(4.6e−02)	(5.3e−02)		(7.2e−02)		(4.9e−02)	
f_9	3.0e+01	2.9e+01	·	3.7e+01	+	4.0e+01	+
	(8.3e+00)	(8.4e+00)		(4.3e+00)		(1.1e+00)	
f_{10}	1.3e−02	1.1e−02	·	1.0e+02	+	3.7e−02	·
	(2.9e−02)	(1.3e−02)		(5.4e+01)		(8.1e−02)	
f_{11}	1.7e+02	1.7e+02	·	1.4e+02	−	1.9e+02	+
	(1.9e+01)	(1.9e+01)		(4.3e+01)		(1.2e+01)	
f_{12}	1.7e+02	1.7e+02	·	1.3e+02	−	2.0e+02	+
	(1.7e+01)	(1.6e+01)		(2.5e+01)		(1.1e+01)	
f_{13}	1.9e+02	1.8e+02	·	2.1e+02	·	1.9e+02	+
	(1.1e+01)	(1.2e+01)		(5.8e+01)		(1.1e+01)	
f_{14}	7.3e+03	7.3e+03	·	7.9e+03	+	7.2e+03	·
	(3.0e+02)	(2.9e+02)		(9.0e+02)		(2.5e+02)	
f_{15}	7.4e+03	7.4e+03	·	8.0e+03	+	7.2e+03	·
	(3.7e+02)	(3.1e+02)		(8.0e+02)		(2.0e+02)	
f_{16}	2.6e+00	2.5e+00	·	3.4e+00	+	2.4e+00	·
	(5.3e−01)	(6.1e−01)		(4.2e−01)		(2.7e−01)	
f_{17}	2.1e+02	2.1e+02	·	3.2e+02	+	2.3e+02	+
	(1.1e+01)	(1.7e+01)		(7.7e+01)		(1.1e+01)	
f_{18}	2.1e+02	2.2e+02	·	3.6e+02	+	2.3e+02	+
	(1.1e+01)	(1.1e+01)		(4.9e+01)		(1.2e+01)	
f_{19}	1.5e+01	1.6e+01	·	3.1e+01	+	1.7e+01	+
	(1.1e+00)	(1.1e+00)		(1.6e+01)		(8.6e−01)	
f_{20}	1.2e+01	1.2e+01	·	1.4e+01	+	1.2e+01	·
	(2.7e−01)	(2.5e−01)		(5.7e−01)		(2.5e−01)	
f_{21}	3.8e+02	3.8e+02	·	8.3e+02	+	3.1e+02	·
	(9.8e+01)	(9.2e+01)		(2.0e+02)		(1.0e+02)	
f_{22}	7.3e+03	7.3e+03	·	8.4e+03	+	7.3e+03	·
	(3.7e+02)	(5.2e+02)		(4.3e+02)		(2.4e+02)	
f_{23}	7.4e+03	7.4e+03	·	8.3e+03	+	7.1e+03	−
	(3.0e+02)	(3.0e+02)		(7.2e+02)		(2.5e+02)	
f_{24}	2.1e+02	2.1e+02	·	2.8e+02	+	2.2e+02	+
	(6.0e+00)	(3.5e+00)		(1.5e+01)		(2.7e+00)	
f_{25}	2.4e+02	2.4e+02	·	2.9e+02	+	2.6e+02	+
	(9.6e+00)	(8.5e+00)		(1.5e+01)		(2.2e+01)	
f_{26}	2.0e+02	2.0e+02	·	2.5e+02	+	2.0e+02	·
	(2.4e−06)	(7.0e−05)		(8.6e+01)		(5.9e−02)	
f_{27}	4.5e+02	4.4e+02	·	1.1e+03	+	8.7e+02	+
	(8.3e+01)	(7.4e+01)		(1.3e+02)		(8.8e+01)	
f_{28}	3.0e+02	3.0e+02	·	1.4e+03	+	3.0e+02	−
	(4.7e−01)	(7.6e−01)		(2.3e+02)		(7.9e−03)	
Summary (+/·/−)		0/28/0		25/1/2		12/12/4	

Table 152: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	2.9e+02	2.0e+00	−	1.7e+04	+	5.1e+02	+
	(6.8e+01)	(8.1e−01)		(8.0e+03)		(5.7e+01)	
f_2	8.8e+06	3.0e+04	−	1.5e+08	+	2.0e+07	+
	(2.0e+06)	(1.3e+04)		(8.4e+07)		(3.0e+06)	
f_3	9.1e+09	1.1e+09	−	5.5e+10	+	1.2e+10	+
	(1.4e+09)	(3.2e+08)		(2.2e+10)		(1.7e+09)	
f_4	1.4e+04	3.4e+01	−	7.9e+04	+	3.2e+04	+
	(2.8e+03)	(1.4e+01)		(2.2e+04)		(4.2e+03)	
f_5	3.4e+01	1.5e+00	−	2.1e+03	+	4.2e+01	+
	(4.2e+00)	(3.8e−01)		(8.7e+02)		(3.8e+00)	
f_6	1.0e+02	1.9e+01	−	1.1e+03	+	1.3e+02	+
	(2.0e+01)	(4.2e+00)		(6.6e+02)		(1.3e+01)	
f_7	9.0e+01	4.2e+01	−	2.2e+02	+	1.1e+02	+
	(8.6e+00)	(5.5e+00)		(4.0e+01)		(8.3e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	+	2.1e+01	·
	(4.9e−02)	(4.1e−02)		(8.2e−02)		(4.6e−02)	
f_9	3.9e+01	3.9e+01	·	4.3e+01	+	3.9e+01	·
	(1.1e+00)	(2.5e+00)		(1.5e+00)		(1.3e+00)	
f_{10}	3.6e+01	1.3e+00	−	1.5e+03	+	6.4e+01	+
	(6.5e+00)	(1.1e−01)		(6.8e+02)		(7.7e+00)	
f_{11}	2.4e+02	1.7e+02	−	4.2e+02	+	2.5e+02	·
	(1.3e+01)	(3.5e+01)		(7.8e+01)		(1.6e+01)	
f_{12}	2.4e+02	1.8e+02	−	4.3e+02	+	2.5e+02	+
	(1.2e+01)	(2.5e+01)		(9.0e+01)		(1.3e+01)	
f_{13}	2.4e+02	1.9e+02	−	4.5e+02	+	2.5e+02	+
	(1.2e+01)	(1.8e+01)		(7.6e+01)		(8.9e+00)	
f_{14}	7.3e+03	7.4e+03	·	7.4e+03	·	7.3e+03	·
	(2.8e+02)	(3.5e+02)		(7.7e+02)		(2.7e+02)	
f_{15}	7.3e+03	7.6e+03	+	7.8e+03	·	7.3e+03	·
	(2.3e+02)	(2.2e+02)		(6.2e+02)		(2.4e+02)	
f_{16}	2.5e+00	2.7e+00	+	2.6e+00	·	2.4e+00	·
	(3.3e−01)	(3.2e−01)		(1.0e+00)		(2.7e−01)	
f_{17}	3.2e+02	2.2e+02	−	1.0e+03	+	3.6e+02	+
	(2.2e+01)	(1.5e+01)		(2.4e+02)		(1.8e+01)	
f_{18}	3.1e+02	2.3e+02	−	1.1e+03	+	3.6e+02	+
	(1.8e+01)	(1.5e+01)		(3.0e+02)		(1.7e+01)	
f_{19}	2.6e+01	1.7e+01	−	1.8e+04	+	3.6e+01	+
	(1.8e+00)	(1.1e+00)		(1.7e+04)		(3.5e+00)	
f_{20}	1.3e+01	1.3e+01	·	1.4e+01	+	1.3e+01	·
	(2.0e−01)	(2.8e−01)		(3.3e−01)		(1.9e−01)	
f_{21}	5.1e+02	4.0e+02	−	2.3e+03	+	6.9e+02	+
	(5.0e+01)	(7.3e+01)		(4.7e+02)		(1.5e+02)	
f_{22}	7.5e+03	7.5e+03	·	8.0e+03	+	7.6e+03	·
	(3.3e+02)	(6.4e+02)		(7.9e+02)		(2.6e+02)	
f_{23}	7.3e+03	7.6e+03	+	8.1e+03	+	7.4e+03	·
	(2.9e+02)	(3.2e+02)		(6.3e+02)		(3.5e+02)	
f_{24}	2.9e+02	2.3e+02	−	3.2e+02	+	3.0e+02	+
	(4.5e+00)	(4.4e+00)		(7.9e+00)		(3.9e+00)	
f_{25}	3.2e+02	2.9e+02	−	3.3e+02	+	3.3e+02	+
	(7.8e+00)	(9.2e+00)		(1.0e+01)		(4.2e+00)	
f_{26}	2.0e+02	2.0e+02	−	2.3e+02	+	2.0e+02	+
	(1.2e−01)	(6.8e−04)		(6.0e+01)		(2.3e−01)	
f_{27}	1.3e+03	7.8e+02	−	1.4e+03	+	1.3e+03	+
	(2.8e+01)	(1.3e+02)		(6.1e+01)		(3.1e+01)	
f_{28}	9.4e+02	3.9e+02	−	2.9e+03	+	1.1e+03	+
	(5.8e+01)	(1.5e+01)		(5.1e+02)		(4.4e+01)	
Summary (+/·/−)		3/5/20		25/3/0		19/9/0	

Table 153: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.1e+04	5.9e+03	−	1.1e+04	·	9.2e+03	·
	(3.9e+03)	(2.4e+03)		(2.8e+03)		(3.6e+03)	
f_2	7.3e+07	1.3e+08	·	7.5e+07	·	6.1e+07	·
	(3.6e+07)	(9.0e+07)		(3.6e+07)		(3.7e+07)	
f_3	5.9e+10	5.9e+10	·	4.7e+10	·	3.4e+10	·
	(7.0e+10)	(3.4e+10)		(3.2e+10)		(2.6e+10)	
f_4	3.6e+04	6.9e+04	+	3.7e+04	·	2.8e+04	−
	(1.2e+04)	(1.3e+04)		(8.7e+03)		(8.6e+03)	
f_5	1.9e+03	5.7e+02	−	2.0e+03	·	1.7e+03	·
	(6.2e+02)	(1.5e+02)		(7.2e+02)		(6.2e+02)	
f_6	7.8e+02	6.2e+02	·	8.3e+02	·	6.8e+02	·
	(3.1e+02)	(4.5e+02)		(3.4e+02)		(2.7e+02)	
f_7	1.7e+02	2.0e+02	·	1.7e+02	·	1.4e+02	·
	(6.5e+01)	(7.0e+01)		(9.2e+01)		(5.0e+01)	
f_8	2.1e+01	2.1e+01	−	2.1e+01	·	2.1e+01	−
	(6.5e−02)	(5.1e−02)		(5.3e−02)		(5.3e−02)	
f_9	2.7e+01	4.0e+01	+	2.7e+01	·	2.4e+01	−
	(2.7e+00)	(1.1e+00)		(2.7e+00)		(2.5e+00)	
f_{10}	1.4e+03	9.5e+02	−	1.4e+03	·	1.2e+03	·
	(4.3e+02)	(5.1e+02)		(4.9e+02)		(4.7e+02)	
f_{11}	2.8e+02	2.5e+02	−	2.8e+02	·	2.5e+02	−
	(6.5e+01)	(4.2e+01)		(6.8e+01)		(5.8e+01)	
f_{12}	2.7e+02	3.0e+02	·	2.9e+02	·	2.5e+02	·
	(6.3e+01)	(6.1e+01)		(7.5e+01)		(5.6e+01)	
f_{13}	3.5e+02	3.0e+02	·	3.6e+02	·	3.2e+02	·
	(5.7e+01)	(5.7e+01)		(6.9e+01)		(5.5e+01)	
f_{14}	6.0e+03	7.4e+03	+	5.8e+03	·	4.1e+03	−
	(1.3e+03)	(3.3e+02)		(1.1e+03)		(1.4e+03)	
f_{15}	6.0e+03	7.6e+03	+	6.0e+03	·	4.2e+03	−
	(1.0e+03)	(2.7e+02)		(1.1e+03)		(1.5e+03)	
f_{16}	3.3e+00	2.6e+00	−	3.3e+00	·	2.4e+00	−
	(5.2e−01)	(3.4e−01)		(4.5e−01)		(2.9e−01)	
f_{17}	4.4e+02	4.1e+02	·	4.5e+02	·	3.4e+02	−
	(9.4e+01)	(5.4e+01)		(7.6e+01)		(8.0e+01)	
f_{18}	4.7e+02	4.0e+02	−	5.0e+02	·	4.2e+02	·
	(8.0e+01)	(5.2e+01)		(7.8e+01)		(8.0e+01)	
f_{19}	3.7e+03	8.2e+02	−	4.6e+03	·	2.1e+03	·
	(5.6e+03)	(9.2e+02)		(7.0e+03)		(2.3e+03)	
f_{20}	1.4e+01	1.5e+01	+	1.4e+01	·	1.3e+01	−
	(1.1e+00)	(3.7e−01)		(1.1e+00)		(1.4e+00)	
f_{21}	1.7e+03	1.3e+03	−	1.8e+03	·	1.7e+03	·
	(3.2e+02)	(2.2e+02)		(2.3e+02)		(3.0e+02)	
f_{22}	6.0e+03	7.8e+03	+	6.1e+03	·	4.2e+03	−
	(1.1e+03)	(3.3e+02)		(1.1e+03)		(8.5e+02)	
f_{23}	6.5e+03	8.0e+03	+	6.5e+03	·	4.5e+03	−
	(1.2e+03)	(2.5e+02)		(1.1e+03)		(1.1e+03)	
f_{24}	2.9e+02	3.2e+02	+	2.9e+02	·	2.9e+02	−
	(9.7e+00)	(7.3e+00)		(7.8e+00)		(7.9e+00)	
f_{25}	3.1e+02	3.4e+02	+	3.1e+02	·	3.1e+02	·
	(9.6e+00)	(6.6e+00)		(1.0e+01)		(8.7e+00)	
f_{26}	3.1e+02	2.1e+02	−	3.1e+02	·	3.2e+02	·
	(8.0e+01)	(1.1e+01)		(8.0e+01)		(7.7e+01)	
f_{27}	1.1e+03	1.4e+03	+	1.1e+03	·	1.0e+03	−
	(7.2e+01)	(3.7e+01)		(6.2e+01)		(7.2e+01)	
f_{28}	2.8e+03	2.3e+03	−	2.7e+03	·	2.5e+03	−
	(5.1e+02)	(4.1e+02)		(4.8e+02)		(4.0e+02)	
Summary (+/·/−)		10/7/11		0/28/0		0/14/14	

Table 154: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	4.8e+00	8.1e+04	+	1.2e+02	+	1.5e−01	−
	(1.1e+01)	(8.3e+03)		(1.1e+02)		(5.1e−01)	
f_2	1.3e+05	1.7e+09	+	5.2e+05	+	5.1e+04	·
	(2.1e+05)	(4.3e+08)		(4.1e+05)		(5.4e+04)	
f_3	4.2e+07	3.2e+19	+	8.2e+08	+	4.5e+06	−
	(7.4e+07)	(1.3e+20)		(1.0e+09)		(2.2e+07)	
f_4	3.7e+01	2.7e+05	+	2.0e+03	+	1.2e+00	−
	(8.3e+01)	(1.9e+05)		(2.2e+03)		(3.6e+00)	
f_5	3.3e+01	3.8e+04	+	7.7e+01	+	1.5e+01	·
	(3.7e+01)	(1.1e+04)		(4.2e+01)		(2.1e+01)	
f_6	4.1e+01	1.7e+04	+	5.8e+01	·	3.8e+01	·
	(2.3e+01)	(3.6e+03)		(2.7e+01)		(2.5e+01)	
f_7	3.4e+01	3.0e+06	+	9.2e+01	+	3.1e+01	·
	(2.1e+01)	(3.4e+06)		(4.5e+01)		(2.6e+01)	
f_8	2.1e+01	2.1e+01	+	2.1e+01	+	2.1e+01	·
	(6.0e−02)	(7.2e−02)		(5.5e−02)		(4.9e−02)	
f_9	1.3e+01	4.7e+01	+	2.2e+01	+	1.0e+01	−
	(2.5e+00)	(1.6e+00)		(6.4e+00)		(2.8e+00)	
f_{10}	6.3e+00	1.2e+04	+	3.0e+01	+	1.4e+00	−
	(9.6e+00)	(1.9e+03)		(2.6e+01)		(3.2e+00)	
f_{11}	2.1e+02	1.3e+03	+	2.4e+02	+	2.2e+02	·
	(2.0e+01)	(1.7e+02)		(4.9e+01)		(2.4e+01)	
f_{12}	2.1e+02	1.2e+03	+	2.4e+02	·	2.1e+02	·
	(2.1e+01)	(1.3e+02)		(4.6e+01)		(2.4e+01)	
f_{13}	2.2e+02	1.3e+03	+	2.7e+02	+	2.1e+02	·
	(2.6e+01)	(1.2e+02)		(4.5e+01)		(2.1e+01)	
f_{14}	7.2e+03	9.3e+03	+	8.0e+03	+	7.3e+03	·
	(4.0e+02)	(3.3e+02)		(3.9e+02)		(3.1e+02)	
f_{15}	7.2e+03	9.3e+03	+	8.0e+03	+	7.2e+03	·
	(3.5e+02)	(4.4e+02)		(3.7e+02)		(3.2e+02)	
f_{16}	2.5e+00	5.1e+00	+	3.4e+00	+	2.4e+00	·
	(2.8e−01)	(7.6e−01)		(4.5e−01)		(2.4e−01)	
f_{17}	2.6e+02	2.3e+03	+	3.4e+02	+	2.5e+02	·
	(2.7e+01)	(2.4e+02)		(4.4e+01)		(2.5e+01)	
f_{18}	2.6e+02	2.4e+03	+	3.4e+02	+	2.6e+02	·
	(2.7e+01)	(2.3e+02)		(4.4e+01)		(2.5e+01)	
f_{19}	1.6e+01	5.8e+06	+	2.4e+01	+	1.7e+01	·
	(2.0e+00)	(2.7e+06)		(4.6e+00)		(2.0e+00)	
f_{20}	1.2e+01	1.5e+01	+	1.3e+01	+	1.2e+01	·
	(7.7e−01)	(3.1e−08)		(6.6e−01)		(7.8e−01)	
f_{21}	3.1e+02	5.4e+03	+	4.6e+02	+	3.0e+02	·
	(7.2e+01)	(4.7e+02)		(8.0e+01)		(8.4e+01)	
f_{22}	7.2e+03	9.9e+03	+	8.2e+03	+	7.4e+03	·
	(4.1e+02)	(3.7e+02)		(5.1e+02)		(3.5e+02)	
f_{23}	7.4e+03	9.9e+03	+	8.5e+03	+	7.3e+03	·
	(3.1e+02)	(3.1e+02)		(3.9e+02)		(4.4e+02)	
f_{24}	2.4e+02	4.8e+02	+	2.6e+02	+	2.4e+02	·
	(1.0e+01)	(5.8e+01)		(9.6e+00)		(8.2e+00)	
f_{25}	2.6e+02	4.3e+02	+	2.8e+02	+	2.6e+02	·
	(8.6e+00)	(1.7e+01)		(7.3e+00)		(7.6e+00)	
f_{26}	2.5e+02	4.2e+02	+	2.7e+02	+	2.6e+02	·
	(6.4e+01)	(3.7e+01)		(7.7e+01)		(6.5e+01)	
f_{27}	6.6e+02	1.8e+03	+	8.6e+02	+	6.1e+02	−
	(5.7e+01)	(9.1e+01)		(1.1e+02)		(5.5e+01)	
f_{28}	5.6e+02	8.6e+03	+	9.8e+02	+	4.7e+02	−
	(3.4e+02)	(1.1e+03)		(3.1e+02)		(3.4e+02)	
Summary (+/·/−)		28/0/0		26/2/0		0/21/7	

Table 155: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	7.0e+03	8.1e+04	+	1.2e+02	−	1.0e+04	+
	(2.5e+03)	(1.0e+04)		(1.1e+02)		(2.5e+03)	
f_2	1.8e+07	1.7e+09	+	4.6e+05	−	2.6e+07	+
	(9.2e+06)	(4.8e+08)		(3.3e+05)		(1.1e+07)	
f_3	2.2e+10	1.2e+19	+	9.5e+08	−	1.1e+11	+
	(5.0e+10)	(2.7e+19)		(2.0e+09)		(3.2e+11)	
f_4	1.5e+04	2.4e+05	+	1.7e+03	−	1.8e+04	+
	(3.8e+03)	(2.0e+05)		(1.5e+03)		(3.9e+03)	
f_5	5.8e+02	3.8e+04	+	8.7e+01	−	6.5e+02	·
	(2.3e+02)	(1.0e+04)		(4.5e+01)		(3.1e+02)	
f_6	7.1e+02	1.6e+04	+	5.7e+01	−	1.0e+03	+
	(2.8e+02)	(3.6e+03)		(2.9e+01)		(2.8e+02)	
f_7	2.3e+01	3.2e+06	+	8.1e+01	+	3.6e+01	·
	(1.3e+01)	(5.9e+06)		(3.5e+01)		(2.5e+01)	
f_8	2.1e+01	2.1e+01	+	2.1e+01	+	2.1e+01	·
	(4.7e−02)	(8.4e−02)		(4.7e−02)		(3.8e−02)	
f_9	1.6e+01	4.7e+01	+	2.2e+01	+	8.7e+00	−
	(9.5e+00)	(1.6e+00)		(6.3e+00)		(1.4e+00)	
f_{10}	8.2e+02	1.2e+04	+	3.2e+01	−	1.2e+03	+
	(2.5e+02)	(1.5e+03)		(3.5e+01)		(3.6e+02)	
f_{11}	1.9e+02	1.3e+03	+	2.3e+02	+	1.9e+02	·
	(1.7e+01)	(1.7e+02)		(4.2e+01)		(2.0e+01)	
f_{12}	1.9e+02	1.3e+03	+	2.4e+02	+	2.0e+02	·
	(1.6e+01)	(1.6e+02)		(4.0e+01)		(2.0e+01)	
f_{13}	1.9e+02	1.2e+03	+	2.6e+02	+	1.9e+02	·
	(1.7e+01)	(1.4e+02)		(3.0e+01)		(2.1e+01)	
f_{14}	7.1e+03	9.3e+03	+	8.0e+03	+	7.1e+03	·
	(3.1e+02)	(4.2e+02)		(6.4e+02)		(2.9e+02)	
f_{15}	7.0e+03	9.2e+03	+	8.0e+03	+	6.8e+03	·
	(2.8e+02)	(4.6e+02)		(4.0e+02)		(2.8e+02)	
f_{16}	2.5e+00	5.2e+00	+	3.5e+00	+	2.5e+00	·
	(2.4e−01)	(8.6e−01)		(3.9e−01)		(2.7e−01)	
f_{17}	2.0e+02	2.4e+03	+	3.2e+02	+	2.0e+02	·
	(1.3e+01)	(2.3e+02)		(3.0e+01)		(1.4e+01)	
f_{18}	2.0e+02	2.4e+03	+	3.4e+02	+	2.0e+02	·
	(1.4e+01)	(2.2e+02)		(5.5e+01)		(1.0e+01)	
f_{19}	4.9e+02	6.5e+06	+	2.4e+01	−	4.5e+02	·
	(8.3e+02)	(2.4e+06)		(5.3e+00)		(4.9e+02)	
f_{20}	1.1e+01	1.5e+01	+	1.4e+01	+	1.1e+01	−
	(2.8e−01)	(1.7e−09)		(6.9e−01)		(2.2e−01)	
f_{21}	7.7e+02	5.4e+03	+	4.7e+02	−	9.0e+02	·
	(1.5e+02)	(4.9e+02)		(6.8e+01)		(2.4e+02)	
f_{22}	6.9e+03	9.9e+03	+	8.3e+03	+	6.7e+03	·
	(3.4e+02)	(3.3e+02)		(4.4e+02)		(2.5e+02)	
f_{23}	6.9e+03	9.8e+03	+	8.4e+03	+	6.7e+03	·
	(3.7e+02)	(3.9e+02)		(4.9e+02)		(3.0e+02)	
f_{24}	2.3e+02	4.8e+02	+	2.6e+02	+	2.5e+02	+
	(6.3e+00)	(5.7e+01)		(1.1e+01)		(7.9e+00)	
f_{25}	2.4e+02	4.2e+02	+	2.8e+02	+	2.5e+02	+
	(1.3e+01)	(2.1e+01)		(9.2e+00)		(1.2e+01)	
f_{26}	2.0e+02	4.2e+02	+	2.9e+02	·	2.2e+02	·
	(7.4e−02)	(3.6e+01)		(7.9e+01)		(3.9e+01)	
f_{27}	5.1e+02	1.8e+03	+	8.7e+02	+	5.3e+02	·
	(4.3e+01)	(7.9e+01)		(9.3e+01)		(4.4e+01)	
f_{28}	1.3e+03	8.5e+03	+	1.1e+03	−	1.5e+03	+
	(2.4e+02)	(1.0e+03)		(3.1e+02)		(2.7e+02)	
Summary (+/·/−)		28/0/0		17/1/10		9/17/2	

Table 156: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	2.0e+03	9.3e+02	−	2.2e+03	·	2.0e+03	·
	(1.2e+03)	(9.3e+02)		(1.3e+03)		(1.3e+03)	
f_2	1.5e+07	1.6e+07	·	1.6e+07	·	9.9e+06	−
	(7.3e+06)	(7.8e+06)		(1.2e+07)		(7.7e+06)	
f_3	5.7e+09	1.1e+10	+	7.3e+09	·	3.0e+09	−
	(3.6e+09)	(7.0e+09)		(6.7e+09)		(2.3e+09)	
f_4	1.1e+04	2.7e+04	+	1.3e+04	·	7.6e+03	·
	(4.7e+03)	(1.3e+04)		(7.3e+03)		(4.4e+03)	
f_5	5.1e+02	1.0e+02	−	5.0e+02	·	3.8e+02	·
	(3.0e+02)	(6.2e+01)		(3.1e+02)		(2.4e+02)	
f_6	2.1e+02	1.7e+02	·	2.1e+02	·	1.8e+02	·
	(7.5e+01)	(3.6e+01)		(7.4e+01)		(6.4e+01)	
f_7	6.2e+01	9.6e+01	+	1.2e+02	+	5.7e+01	·
	(1.8e+01)	(3.3e+01)		(3.8e+01)		(2.1e+01)	
f_8	2.1e+01	2.1e+01	+	2.1e+01	+	2.1e+01	·
	(5.3e−02)	(5.9e−02)		(6.3e−02)		(5.1e−02)	
f_9	1.7e+01	2.8e+01	+	2.3e+01	+	1.6e+01	·
	(2.5e+00)	(5.1e+00)		(3.5e+00)		(2.6e+00)	
f_{10}	3.2e+02	2.0e+02	−	4.2e+02	·	3.2e+02	·
	(1.9e+02)	(1.1e+02)		(2.1e+02)		(2.0e+02)	
f_{11}	1.1e+02	1.6e+02	+	1.9e+02	+	1.1e+02	·
	(2.8e+01)	(2.9e+01)		(3.9e+01)		(3.0e+01)	
f_{12}	1.1e+02	1.7e+02	+	2.1e+02	+	1.1e+02	·
	(3.5e+01)	(4.4e+01)		(5.7e+01)		(2.8e+01)	
f_{13}	1.8e+02	2.3e+02	+	2.9e+02	+	1.8e+02	·
	(3.8e+01)	(4.3e+01)		(6.2e+01)		(3.9e+01)	
f_{14}	6.9e+03	7.3e+03	+	7.7e+03	+	6.9e+03	·
	(5.6e+02)	(3.3e+02)		(6.8e+02)		(4.7e+02)	
f_{15}	6.6e+03	7.4e+03	+	7.9e+03	+	6.9e+03	·
	(8.2e+02)	(3.0e+02)		(4.3e+02)		(3.7e+02)	
f_{16}	2.3e+00	2.6e+00	+	3.5e+00	+	2.4e+00	·
	(2.5e−01)	(2.8e−01)		(5.1e−01)		(3.1e−01)	
f_{17}	2.5e+02	2.4e+02	·	3.9e+02	+	2.6e+02	·
	(3.2e+01)	(2.5e+01)		(6.3e+01)		(3.2e+01)	
f_{18}	2.5e+02	2.4e+02	·	4.0e+02	+	2.6e+02	·
	(3.6e+01)	(2.0e+01)		(6.2e+01)		(3.5e+01)	
f_{19}	4.0e+01	3.2e+01	·	6.1e+01	·	3.1e+01	·
	(5.5e+01)	(1.3e+01)		(7.6e+01)		(4.0e+01)	
f_{20}	1.2e+01	1.4e+01	+	1.3e+01	+	1.2e+01	·
	(4.9e−01)	(7.7e−01)		(8.5e−01)		(9.3e−01)	
f_{21}	1.0e+03	6.1e+02	−	1.0e+03	·	8.5e+02	·
	(2.7e+02)	(1.1e+02)		(2.8e+02)		(1.7e+02)	
f_{22}	6.1e+03	7.4e+03	+	7.6e+03	+	6.8e+03	·
	(1.4e+03)	(4.4e+02)		(1.1e+03)		(7.4e+02)	
f_{23}	6.1e+03	7.6e+03	+	7.9e+03	+	6.6e+03	·
	(1.3e+03)	(2.4e+02)		(7.7e+02)		(1.1e+03)	
f_{24}	2.6e+02	2.8e+02	+	2.7e+02	+	2.6e+02	·
	(1.0e+01)	(1.8e+01)		(7.4e+00)		(1.1e+01)	
f_{25}	2.9e+02	3.2e+02	+	2.9e+02	·	2.8e+02	·
	(9.0e+00)	(9.8e+00)		(9.3e+00)		(9.8e+00)	
f_{26}	2.6e+02	2.0e+02	·	2.9e+02	+	2.7e+02	·
	(7.0e+01)	(1.0e+00)		(7.9e+01)		(7.2e+01)	
f_{27}	8.2e+02	1.1e+03	+	9.4e+02	+	7.9e+02	·
	(9.4e+01)	(1.6e+02)		(9.5e+01)		(7.4e+01)	
f_{28}	1.4e+03	1.5e+03	·	1.8e+03	·	1.4e+03	·
	(3.1e+02)	(2.3e+02)		(3.9e+02)		(2.7e+02)	
Summary (+/·/−)		17/7/4		17/11/0		0/26/2	

Table 157: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.2e−09	3.0e+00	+	5.6e+02	+	0.0e+00	·
	(3.6e−09)	(9.3e+00)		(5.2e+02)		(0.0e+00)	
f_2	5.0e−05	4.8e+03	+	1.4e+05	+	3.4e−05	·
	(2.9e−05)	(8.5e+03)		(1.3e+05)		(9.5e−06)	
f_3	2.6e+04	8.3e+06	+	6.6e+09	+	3.8e+05	+
	(3.9e+04)	(1.3e+07)		(4.9e+09)		(1.8e+05)	
f_4	9.4e−08	1.4e+01	+	1.7e+04	+	3.9e−08	−
	(7.1e−08)	(2.7e+01)		(9.1e+03)		(1.0e−08)	
f_5	1.0e−06	2.0e−01	+	6.2e+01	+	1.0e−06	·
	(4.9e−07)	(3.8e−01)		(4.1e+01)		(1.9e−07)	
f_6	1.1e+01	2.8e+01	+	5.7e+01	+	5.6e−01	−
	(8.0e+00)	(2.4e+01)		(3.4e+01)		(5.3e−01)	
f_7	1.9e+00	4.4e+00	+	8.1e+01	+	1.4e+01	+
	(1.0e+00)	(2.7e+00)		(2.7e+01)		(2.4e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	+	2.1e+01	·
	(5.6e−02)	(6.4e−02)		(6.3e−02)		(3.6e−02)	
f_9	3.5e+01	2.1e+01	−	3.5e+01	·	3.9e+01	+
	(8.2e+00)	(9.8e+00)		(4.9e+00)		(1.0e+00)	
f_{10}	1.5e−07	7.9e−01	+	4.4e+01	+	5.2e−03	·
	(7.5e−08)	(8.8e−01)		(3.4e+01)		(1.3e−02)	
f_{11}	1.8e+02	1.7e+02	−	1.3e+02	−	1.9e+02	·
	(8.9e+00)	(1.5e+01)		(3.4e+01)		(1.0e+01)	
f_{12}	1.8e+02	1.7e+02	·	1.2e+02	−	1.9e+02	·
	(9.6e+00)	(2.0e+01)		(3.1e+01)		(1.1e+01)	
f_{13}	1.8e+02	1.8e+02	·	2.2e+02	+	1.9e+02	·
	(1.1e+01)	(1.4e+01)		(5.2e+01)		(9.2e+00)	
f_{14}	7.1e+03	7.3e+03	+	8.0e+03	+	7.2e+03	·
	(2.8e+02)	(3.1e+02)		(7.0e+02)		(2.3e+02)	
f_{15}	7.1e+03	7.4e+03	+	8.0e+03	+	7.3e+03	·
	(2.7e+02)	(2.7e+02)		(7.3e+02)		(2.3e+02)	
f_{16}	2.5e+00	2.7e+00	·	3.5e+00	+	2.5e+00	·
	(2.7e−01)	(3.2e−01)		(3.3e−01)		(2.7e−01)	
f_{17}	2.1e+02	2.1e+02	·	3.2e+02	+	2.3e+02	+
	(1.1e+01)	(9.0e+00)		(7.2e+01)		(9.7e+00)	
f_{18}	2.1e+02	2.2e+02	·	3.3e+02	+	2.2e+02	+
	(8.5e+00)	(1.1e+01)		(7.1e+01)		(1.1e+01)	
f_{19}	1.5e+01	1.5e+01	·	2.4e+01	+	1.6e+01	·
	(1.0e+00)	(1.4e+00)		(1.1e+01)		(9.5e−01)	
f_{20}	1.2e+01	1.2e+01	·	1.4e+01	+	1.2e+01	·
	(2.6e−01)	(2.4e−01)		(4.6e−01)		(2.9e−01)	
f_{21}	3.5e+02	3.7e+02	+	6.8e+02	+	3.1e+02	·
	(1.0e+02)	(9.6e+01)		(1.6e+02)		(1.1e+02)	
f_{22}	7.2e+03	7.3e+03	·	8.2e+03	+	7.2e+03	·
	(3.2e+02)	(4.0e+02)		(8.2e+02)		(3.4e+02)	
f_{23}	7.1e+03	7.3e+03	+	8.5e+03	+	7.1e+03	·
	(2.2e+02)	(3.7e+02)		(6.6e+02)		(2.6e+02)	
f_{24}	2.0e+02	2.1e+02	+	2.8e+02	+	2.1e+02	+
	(3.9e+00)	(4.2e+00)		(1.5e+01)		(1.1e+00)	
f_{25}	2.4e+02	2.4e+02	·	2.9e+02	+	2.3e+02	·
	(1.4e+01)	(6.7e+00)		(1.6e+01)		(2.5e+01)	
f_{26}	2.0e+02	2.0e+02	+	2.5e+02	+	2.0e+02	·
	(9.2e−11)	(1.2e−03)		(8.5e+01)		(5.3e−10)	
f_{27}	3.8e+02	4.3e+02	+	1.1e+03	+	5.8e+02	+
	(6.2e+01)	(7.4e+01)		(1.4e+02)		(4.5e+01)	
f_{28}	3.0e+02	3.3e+02	+	1.3e+03	+	3.0e+02	−
	(1.4e−03)	(3.8e+01)		(2.7e+02)		(2.8e−04)	
Summary (+/·/−)		16/10/2		25/1/2		7/18/3	

Table 158: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	7.2e+03	3.4e+04	+	1.6e+02	−	3.2e−03	−
	(2.4e+03)	(5.3e+03)		(4.0e+02)		(1.2e−02)	
f_2	4.0e+07	5.0e+08	+	4.4e+05	−	3.5e+04	−
	(2.3e+07)	(2.0e+08)		(5.3e+05)		(5.5e+04)	
f_3	2.1e+10	1.7e+15	+	1.3e+09	−	1.1e+06	−
	(1.1e+10)	(3.6e+15)		(2.3e+09)		(3.1e+06)	
f_4	2.5e+04	5.5e+04	+	1.6e+03	−	1.7e−02	−
	(8.1e+03)	(8.6e+03)		(1.9e+03)		(7.1e−02)	
f_5	1.1e+03	9.8e+03	+	6.0e+01	−	4.7e+00	−
	(3.9e+02)	(3.1e+03)		(3.7e+01)		(1.5e+01)	
f_6	5.5e+02	5.2e+03	+	5.1e+01	−	3.1e+01	−
	(3.0e+02)	(1.3e+03)		(3.0e+01)		(2.3e+01)	
f_7	5.5e+01	1.6e+04	+	8.2e+01	+	2.4e+01	−
	(1.7e+01)	(2.1e+04)		(3.1e+01)		(1.7e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	+	2.1e+01	·
	(4.2e−02)	(4.9e−02)		(5.1e−02)		(5.6e−02)	
f_9	1.5e+01	3.1e+01	+	2.3e+01	+	9.2e+00	−
	(1.8e+00)	(1.3e+00)		(5.9e+00)		(3.6e+00)	
f_{10}	9.0e+02	4.9e+03	+	2.6e+01	−	1.3e+00	−
	(3.9e+02)	(9.8e+02)		(2.0e+01)		(5.4e+00)	
f_{11}	1.0e+02	5.3e+02	+	2.4e+02	+	2.2e+02	+
	(2.9e+01)	(6.7e+01)		(4.0e+01)		(2.3e+01)	
f_{12}	1.2e+02	5.2e+02	+	2.5e+02	+	2.1e+02	+
	(3.3e+01)	(7.3e+01)		(4.8e+01)		(2.1e+01)	
f_{13}	1.6e+02	5.4e+02	+	2.6e+02	+	2.1e+02	+
	(4.3e+01)	(6.9e+01)		(3.1e+01)		(2.1e+01)	
f_{14}	6.9e+03	5.4e+03	−	7.9e+03	+	7.2e+03	+
	(3.2e+02)	(4.4e+02)		(4.4e+02)		(3.3e+02)	
f_{15}	6.8e+03	5.4e+03	−	8.1e+03	+	7.3e+03	+
	(3.0e+02)	(4.0e+02)		(3.6e+02)		(3.9e+02)	
f_{16}	2.4e+00	2.6e+00	+	3.5e+00	+	2.4e+00	·
	(2.9e−01)	(3.2e−01)		(4.0e−01)		(3.3e−01)	
f_{17}	2.6e+02	6.8e+02	+	3.3e+02	+	2.5e+02	·
	(3.2e+01)	(1.2e+02)		(3.6e+01)		(2.6e+01)	
f_{18}	2.6e+02	6.7e+02	+	3.5e+02	+	2.6e+02	·
	(3.2e+01)	(1.4e+02)		(3.7e+01)		(2.9e+01)	
f_{19}	1.2e+03	1.8e+05	+	2.3e+01	−	1.7e+01	−
	(1.7e+03)	(1.1e+05)		(6.0e+00)		(1.7e+00)	
f_{20}	1.1e+01	1.4e+01	+	1.4e+01	+	1.2e+01	+
	(3.4e−01)	(6.0e−01)		(6.0e−01)		(6.5e−01)	
f_{21}	1.4e+03	2.6e+03	+	4.4e+02	−	3.3e+02	−
	(2.9e+02)	(2.1e+02)		(7.0e+01)		(8.8e+01)	
f_{22}	6.5e+03	5.7e+03	−	8.1e+03	+	7.4e+03	+
	(3.3e+02)	(4.8e+02)		(5.5e+02)		(4.3e+02)	
f_{23}	6.6e+03	5.7e+03	−	8.3e+03	+	7.4e+03	+
	(3.5e+02)	(4.7e+02)		(4.2e+02)		(4.2e+02)	
f_{24}	2.7e+02	3.7e+02	+	2.6e+02	·	2.4e+02	−
	(1.0e+01)	(2.6e+01)		(8.8e+00)		(8.6e+00)	
f_{25}	2.9e+02	3.7e+02	+	2.7e+02	−	2.6e+02	−
	(9.8e+00)	(1.2e+01)		(9.6e+00)		(6.2e+00)	
f_{26}	2.5e+02	2.7e+02	+	2.8e+02	·	2.7e+02	·
	(6.6e+01)	(5.1e+01)		(7.8e+01)		(6.3e+01)	
f_{27}	7.8e+02	1.3e+03	+	8.7e+02	+	6.1e+02	−
	(6.9e+01)	(4.7e+01)		(1.1e+02)		(5.4e+01)	
f_{28}	2.1e+03	4.7e+03	+	9.8e+02	−	3.7e+02	−
	(3.2e+02)	(5.3e+02)		(2.9e+02)		(2.8e+02)	
Summary (+/·/−)		23/1/4		15/2/11		8/5/15	

Table 159: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	5.6e+00	5.7e+00	·	3.5e+00	−	1.4e+02	+
	(1.2e+00)	(1.5e+00)		(1.6e+01)		(1.5e+01)	
f_2	3.9e+07	4.2e+07	·	1.4e+06	−	7.8e+07	+
	(8.3e+06)	(7.5e+06)		(7.3e+05)		(1.1e+07)	
f_3	2.3e+09	2.2e+09	·	1.5e+08	−	8.8e+09	+
	(4.2e+08)	(3.9e+08)		(2.2e+08)		(1.1e+09)	
f_4	5.1e+04	5.2e+04	·	1.4e+04	−	6.0e+04	+
	(7.1e+03)	(7.2e+03)		(4.4e+03)		(6.6e+03)	
f_5	3.4e+00	3.3e+00	·	6.8e−01	−	2.2e+01	+
	(6.3e−01)	(5.6e−01)		(3.2e+00)		(2.5e+00)	
f_6	4.0e+01	3.9e+01	·	3.1e+01	−	1.2e+02	+
	(7.8e+00)	(7.8e+00)		(2.4e+01)		(9.8e+00)	
f_7	6.4e+01	6.4e+01	·	3.9e+01	−	9.6e+01	+
	(4.9e+00)	(5.0e+00)		(1.6e+01)		(7.2e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.7e−02)	(5.5e−02)		(5.0e−02)		(4.5e−02)	
f_9	3.9e+01	3.9e+01	·	1.9e+01	−	3.9e+01	·
	(1.1e+00)	(9.8e−01)		(3.8e+00)		(1.2e+00)	
f_{10}	3.7e+01	3.6e+01	·	7.2e+00	−	2.5e+02	+
	(7.9e+00)	(8.9e+00)		(2.7e+01)		(2.9e+01)	
f_{11}	1.7e+02	1.7e+02	·	4.3e+01	−	2.2e+02	+
	(1.2e+01)	(1.1e+01)		(1.5e+01)		(1.1e+01)	
f_{12}	2.2e+02	2.2e+02	·	7.7e+01	−	2.5e+02	+
	(1.2e+01)	(1.1e+01)		(1.9e+01)		(1.1e+01)	
f_{13}	2.2e+02	2.2e+02	·	1.4e+02	−	2.5e+02	+
	(1.3e+01)	(1.3e+01)		(2.9e+01)		(1.4e+01)	
f_{14}	5.3e+03	5.2e+03	·	1.0e+03	−	6.9e+03	+
	(3.3e+02)	(2.7e+02)		(3.1e+02)		(2.9e+02)	
f_{15}	7.3e+03	7.3e+03	·	3.7e+03	−	7.3e+03	·
	(2.6e+02)	(2.8e+02)		(5.9e+02)		(3.0e+02)	
f_{16}	2.5e+00	2.5e+00	·	2.1e+00	−	2.5e+00	·
	(2.8e−01)	(2.7e−01)		(4.4e−01)		(3.0e−01)	
f_{17}	2.2e+02	2.2e+02	·	1.1e+02	−	3.1e+02	+
	(1.4e+01)	(1.4e+01)		(3.5e+01)		(1.6e+01)	
f_{18}	2.5e+02	2.5e+02	·	1.4e+02	−	3.3e+02	+
	(1.3e+01)	(1.3e+01)		(3.5e+01)		(1.3e+01)	
f_{19}	1.8e+01	1.8e+01	·	7.6e+00	−	2.8e+01	+
	(1.3e+00)	(1.1e+00)		(5.6e+00)		(2.2e+00)	
f_{20}	1.3e+01	1.3e+01	·	1.2e+01	−	1.3e+01	·
	(2.3e−01)	(2.4e−01)		(5.0e−01)		(1.8e−01)	
f_{21}	3.6e+02	3.7e+02	·	3.1e+02	−	7.8e+02	+
	(5.0e+01)	(5.4e+01)		(8.2e+01)		(2.3e+02)	
f_{22}	5.6e+03	5.7e+03	·	1.1e+03	−	7.2e+03	+
	(3.4e+02)	(3.1e+02)		(3.2e+02)		(2.7e+02)	
f_{23}	7.4e+03	7.4e+03	·	4.1e+03	−	7.5e+03	·
	(3.1e+02)	(2.9e+02)		(6.5e+02)		(2.3e+02)	
f_{24}	2.6e+02	2.6e+02	·	2.5e+02	−	2.9e+02	+
	(4.5e+00)	(6.1e+00)		(9.8e+00)		(3.8e+00)	
f_{25}	3.1e+02	3.1e+02	·	2.6e+02	−	3.2e+02	+
	(6.5e+00)	(7.8e+00)		(6.2e+00)		(3.3e+00)	
f_{26}	2.0e+02	2.0e+02	·	2.2e+02	−	2.1e+02	+
	(6.6e−01)	(5.6e−01)		(4.7e+01)		(1.2e+00)	
f_{27}	1.2e+03	1.3e+03	·	7.8e+02	−	1.3e+03	+
	(5.7e+01)	(6.0e+01)		(1.0e+02)		(3.2e+01)	
f_{28}	4.4e+02	4.4e+02	·	4.1e+02	−	8.5e+02	+
	(1.7e+01)	(1.7e+01)		(2.9e+02)		(3.2e+01)	
Summary (+/·/−)		0/28/0		0/1/27		22/6/0	

Table 160: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	6.4e+03	3.4e+03	−	1.8e+03	−	7.0e+03	·
	(1.0e+03)	(4.7e+02)		(1.1e+03)		(6.0e+02)	
f_2	1.8e+08	1.5e+08	−	1.8e+07	−	1.9e+08	·
	(3.3e+07)	(3.1e+07)		(1.2e+07)		(3.5e+07)	
f_3	3.1e+10	2.4e+10	−	4.3e+09	−	3.6e+10	+
	(3.9e+09)	(3.8e+09)		(3.9e+09)		(5.5e+09)	
f_4	7.2e+04	7.0e+04	·	3.0e+04	−	7.0e+04	·
	(7.8e+03)	(8.3e+03)		(1.2e+04)		(8.1e+03)	
f_5	4.7e+02	3.5e+02	−	2.3e+02	−	4.3e+02	·
	(5.5e+01)	(3.7e+01)		(2.5e+02)		(4.8e+01)	
f_6	5.5e+02	3.3e+02	−	1.6e+02	−	6.3e+02	+
	(7.5e+01)	(3.7e+01)		(4.7e+01)		(7.5e+01)	
f_7	1.6e+02	1.4e+02	−	7.3e+01	−	1.7e+02	·
	(1.5e+01)	(1.1e+01)		(2.4e+01)		(1.7e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.4e−02)	(5.4e−02)		(6.1e−02)		(5.8e−02)	
f_9	4.0e+01	3.9e+01	·	2.8e+01	−	4.0e+01	·
	(1.0e+00)	(1.2e+00)		(3.8e+00)		(8.6e−01)	
f_{10}	1.4e+03	1.1e+03	−	3.3e+02	−	1.5e+03	+
	(1.8e+02)	(1.4e+02)		(1.9e+02)		(1.8e+02)	
f_{11}	3.1e+02	1.9e+02	−	1.2e+02	−	3.1e+02	·
	(1.5e+01)	(1.5e+01)		(2.6e+01)		(1.4e+01)	
f_{12}	3.3e+02	3.0e+02	−	2.1e+02	−	3.4e+02	·
	(2.2e+01)	(2.2e+01)		(4.5e+01)		(1.9e+01)	
f_{13}	3.4e+02	3.1e+02	−	2.3e+02	−	3.5e+02	·
	(2.1e+01)	(1.8e+01)		(4.3e+01)		(1.7e+01)	
f_{14}	7.0e+03	4.6e+03	−	1.9e+03	−	6.9e+03	·
	(2.6e+02)	(2.8e+02)		(4.7e+02)		(3.3e+02)	
f_{15}	7.5e+03	7.3e+03	·	6.0e+03	−	7.4e+03	·
	(2.2e+02)	(3.1e+02)		(5.6e+02)		(2.6e+02)	
f_{16}	2.5e+00	2.5e+00	·	2.2e+00	−	2.5e+00	·
	(2.6e−01)	(2.7e−01)		(4.0e−01)		(2.9e−01)	
f_{17}	6.3e+02	4.8e+02	−	2.7e+02	−	7.4e+02	+
	(6.7e+01)	(3.8e+01)		(6.3e+01)		(5.5e+01)	
f_{18}	6.4e+02	4.9e+02	−	3.6e+02	−	7.4e+02	+
	(4.9e+01)	(4.6e+01)		(5.8e+01)		(5.1e+01)	
f_{19}	9.1e+02	3.0e+02	−	2.5e+02	−	1.1e+03	·
	(3.7e+02)	(1.3e+02)		(4.3e+02)		(3.4e+02)	
f_{20}	1.4e+01	1.4e+01	·	1.3e+01	−	1.4e+01	·
	(2.1e−01)	(1.8e−01)		(4.4e−01)		(2.2e−01)	
f_{21}	1.8e+03	1.5e+03	−	1.0e+03	−	1.9e+03	+
	(1.5e+02)	(1.4e+02)		(2.7e+02)		(1.0e+02)	
f_{22}	7.5e+03	4.9e+03	−	2.3e+03	−	7.5e+03	·
	(3.4e+02)	(3.8e+02)		(4.4e+02)		(2.4e+02)	
f_{23}	7.7e+03	7.7e+03	·	6.1e+03	−	7.8e+03	·
	(2.5e+02)	(2.8e+02)		(7.3e+02)		(3.1e+02)	
f_{24}	3.1e+02	3.0e+02	−	2.7e+02	−	3.1e+02	·
	(3.6e+00)	(3.2e+00)		(9.6e+00)		(3.1e+00)	
f_{25}	3.3e+02	3.2e+02	−	2.8e+02	−	3.3e+02	+
	(2.8e+00)	(3.3e+00)		(1.0e+01)		(4.6e+00)	
f_{26}	2.2e+02	2.1e+02	−	2.0e+02	−	2.2e+02	·
	(3.3e+00)	(2.4e+00)		(9.1e−01)		(3.4e+00)	
f_{27}	1.4e+03	1.3e+03	−	1.0e+03	−	1.4e+03	·
	(2.8e+01)	(3.4e+01)		(1.1e+02)		(3.1e+01)	
f_{28}	2.3e+03	2.0e+03	−	1.3e+03	−	2.3e+03	·
	(9.4e+01)	(1.0e+02)		(2.7e+02)		(7.2e+01)	
Summary (+/·/−)		0/7/21		0/1/27		7/21/0	

Table 161: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	1.3e+01	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(3.8e+01)		(0.0e+00)		(0.0e+00)	
f_2	2.8e+05	1.8e+07	+	2.5e+05	·	3.7e+05	·
	(1.2e+05)	(1.2e+07)		(1.2e+05)		(2.2e+05)	
f_3	1.2e+07	5.1e+09	+	1.1e+07	·	1.6e+07	·
	(2.4e+07)	(5.1e+09)		(3.7e+07)		(5.1e+07)	
f_4	6.6e+02	2.7e+04	+	7.2e+02	·	3.3e+03	+
	(2.4e+02)	(6.3e+03)		(3.4e+02)		(1.2e+03)	
f_5	0.0e+00	2.0e+02	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(2.3e+02)		(0.0e+00)		(0.0e+00)	
f_6	8.9e+00	8.2e+01	+	1.0e+01	·	1.1e+01	·
	(1.0e+01)	(3.0e+01)		(1.1e+01)		(1.1e+01)	
f_7	2.9e+01	4.4e+01	+	3.0e+01	·	2.7e+01	·
	(1.7e+01)	(1.7e+01)		(1.9e+01)		(1.5e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(7.4e−02)	(5.2e−02)		(5.1e−02)		(4.5e−02)	
f_9	1.3e+01	1.5e+01	+	1.3e+01	·	1.5e+01	·
	(3.3e+00)	(3.2e+00)		(3.3e+00)		(1.1e+01)	
f_{10}	2.0e−02	8.2e+01	+	1.9e−02	·	6.6e−03	·
	(1.7e−02)	(5.5e+01)		(1.4e−02)		(8.0e−03)	
f_{11}	7.2e+01	2.9e+01	−	7.3e+01	·	1.9e+02	+
	(2.1e+01)	(1.1e+01)		(2.1e+01)		(1.4e+01)	
f_{12}	7.4e+01	4.6e+01	−	7.3e+01	·	2.0e+02	+
	(2.4e+01)	(1.5e+01)		(2.6e+01)		(1.2e+01)	
f_{13}	1.4e+02	8.7e+01	−	1.3e+02	·	2.0e+02	+
	(3.7e+01)	(2.8e+01)		(3.3e+01)		(1.6e+01)	
f_{14}	1.9e+03	1.7e+03	·	1.9e+03	·	6.8e+03	+
	(5.3e+02)	(4.1e+02)		(5.0e+02)		(3.7e+02)	
f_{15}	4.2e+03	3.6e+03	·	4.1e+03	·	7.3e+03	+
	(7.3e+02)	(1.5e+03)		(7.1e+02)		(2.8e+02)	
f_{16}	1.8e+00	2.5e+00	+	1.9e+00	·	2.5e+00	+
	(4.9e−01)	(2.5e−01)		(4.9e−01)		(2.6e−01)	
f_{17}	1.1e+02	1.1e+02	·	1.2e+02	·	2.2e+02	+
	(2.3e+01)	(1.2e+01)		(2.4e+01)		(1.7e+01)	
f_{18}	1.3e+02	1.9e+02	+	1.3e+02	·	2.3e+02	+
	(2.2e+01)	(8.7e+00)		(2.5e+01)		(1.5e+01)	
f_{19}	4.9e+00	7.3e+00	·	4.3e+00	·	1.6e+01	+
	(1.6e+00)	(4.1e+00)		(1.2e+00)		(1.2e+00)	
f_{20}	1.2e+01	1.2e+01	·	1.2e+01	·	1.3e+01	+
	(8.9e−01)	(4.8e−01)		(8.7e−01)		(3.9e−01)	
f_{21}	3.1e+02	5.4e+02	+	3.2e+02	·	3.0e+02	+
	(7.8e+01)	(2.4e+02)		(8.2e+01)		(7.9e+01)	
f_{22}	2.1e+03	1.5e+03	−	2.2e+03	·	7.0e+03	+
	(4.6e+02)	(3.7e+02)		(6.0e+02)		(3.7e+02)	
f_{23}	4.4e+03	3.3e+03	·	4.3e+03	·	7.5e+03	+
	(8.9e+02)	(1.3e+03)		(7.0e+02)		(2.7e+02)	
f_{24}	2.4e+02	2.4e+02	·	2.4e+02	·	2.3e+02	·
	(1.2e+01)	(9.7e+00)		(7.8e+00)		(1.2e+01)	
f_{25}	2.6e+02	2.7e+02	·	2.6e+02	·	2.5e+02	−
	(8.4e+00)	(7.2e+00)		(5.9e+00)		(6.5e+00)	
f_{26}	2.4e+02	2.0e+02	·	2.5e+02	·	2.4e+02	·
	(6.1e+01)	(8.5e−01)		(6.5e+01)		(5.9e+01)	
f_{27}	6.7e+02	7.3e+02	+	6.5e+02	·	6.1e+02	−
	(6.6e+01)	(7.1e+01)		(8.1e+01)		(7.7e+01)	
f_{28}	3.6e+02	7.0e+02	+	3.6e+02	·	3.6e+02	+
	(2.6e+02)	(2.3e+02)		(2.6e+02)		(2.5e+02)	
Summary (+/·/−)		14/10/4		0/28/0		15/11/2	

Table 162: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.5e+03	3.9e+00	−	5.9e+00	−	2.3e+03	+
	(3.5e+02)	(9.7e−01)		(1.8e+01)		(3.4e+02)	
f_2	7.9e+07	4.0e+07	−	1.4e+06	−	9.2e+07	·
	(2.0e+07)	(6.9e+06)		(7.9e+05)		(1.8e+07)	
f_3	1.6e+10	2.0e+09	−	1.1e+08	−	1.8e+10	·
	(3.4e+09)	(3.7e+08)		(1.4e+08)		(3.9e+09)	
f_4	4.2e+04	5.1e+04	+	1.4e+04	−	4.2e+04	·
	(6.0e+03)	(6.1e+03)		(5.1e+03)		(7.5e+03)	
f_5	9.3e+01	2.7e+00	−	7.7e−01	−	1.2e+02	+
	(1.2e+01)	(4.4e−01)		(2.7e+00)		(1.4e+01)	
f_6	1.8e+02	3.5e+01	−	2.8e+01	−	2.3e+02	+
	(2.7e+01)	(7.1e+00)		(2.2e+01)		(3.8e+01)	
f_7	1.2e+02	6.2e+01	−	3.1e+01	−	1.2e+02	·
	(1.4e+01)	(5.2e+00)		(1.3e+01)		(1.4e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.2e−02)	(5.7e−02)		(4.9e−02)		(6.2e−02)	
f_9	3.9e+01	3.9e+01	·	2.0e+01	−	4.0e+01	·
	(1.1e+00)	(1.0e+00)		(4.7e+00)		(1.0e+00)	
f_{10}	4.6e+02	3.3e+01	−	1.8e+00	−	5.7e+02	+
	(7.3e+01)	(6.4e+00)		(5.0e+00)		(8.9e+01)	
f_{11}	2.5e+02	1.7e+02	−	4.3e+01	−	2.6e+02	+
	(1.8e+01)	(1.2e+01)		(1.4e+01)		(1.7e+01)	
f_{12}	2.8e+02	2.2e+02	−	8.1e+01	−	3.0e+02	·
	(2.1e+01)	(8.6e+00)		(2.1e+01)		(1.9e+01)	
f_{13}	2.9e+02	2.2e+02	−	1.3e+02	−	3.0e+02	·
	(1.7e+01)	(1.0e+01)		(3.3e+01)		(2.0e+01)	
f_{14}	6.5e+03	5.3e+03	−	1.1e+03	−	7.0e+03	+
	(4.1e+02)	(3.6e+02)		(3.5e+02)		(2.9e+02)	
f_{15}	7.3e+03	7.2e+03	·	3.7e+03	−	7.3e+03	·
	(3.2e+02)	(2.7e+02)		(6.3e+02)		(2.7e+02)	
f_{16}	2.5e+00	2.5e+00	·	2.2e+00	·	2.5e+00	·
	(2.6e−01)	(3.1e−01)		(4.6e−01)		(2.6e−01)	
f_{17}	4.1e+02	2.2e+02	−	1.1e+02	−	4.9e+02	+
	(4.3e+01)	(1.4e+01)		(3.1e+01)		(5.2e+01)	
f_{18}	4.4e+02	2.5e+02	−	1.2e+02	−	5.1e+02	+
	(5.3e+01)	(1.5e+01)		(2.7e+01)		(5.3e+01)	
f_{19}	7.4e+01	1.8e+01	−	8.1e+00	−	1.4e+02	+
	(2.5e+01)	(9.2e−01)		(6.5e+00)		(5.8e+01)	
f_{20}	1.3e+01	1.3e+01	−	1.2e+01	−	1.3e+01	·
	(2.8e−01)	(2.7e−01)		(6.6e−01)		(2.2e−01)	
f_{21}	9.8e+02	3.6e+02	−	3.0e+02	−	1.1e+03	+
	(1.8e+02)	(4.5e+01)		(8.3e+01)		(2.1e+02)	
f_{22}	6.8e+03	5.7e+03	−	1.2e+03	−	7.2e+03	·
	(5.5e+02)	(3.5e+02)		(3.5e+02)		(3.1e+02)	
f_{23}	7.5e+03	7.3e+03	·	4.0e+03	−	7.5e+03	·
	(3.0e+02)	(3.4e+02)		(6.4e+02)		(3.1e+02)	
f_{24}	3.0e+02	2.6e+02	−	2.5e+02	−	3.0e+02	·
	(6.6e+00)	(5.9e+00)		(9.8e+00)		(5.2e+00)	
f_{25}	3.1e+02	3.1e+02	·	2.6e+02	−	3.1e+02	·
	(8.1e+00)	(6.6e+00)		(9.9e+00)		(7.9e+00)	
f_{26}	2.1e+02	2.0e+02	−	2.1e+02	−	2.1e+02	·
	(2.7e+01)	(5.2e−01)		(2.8e+01)		(2.1e+00)	
f_{27}	1.3e+03	1.2e+03	−	7.6e+02	−	1.3e+03	·
	(4.0e+01)	(5.4e+01)		(8.2e+01)		(3.4e+01)	
f_{28}	1.6e+03	4.3e+02	−	3.4e+02	−	1.8e+03	+
	(9.6e+01)	(1.6e+01)		(1.6e+02)		(1.3e+02)	
Summary (+/·/−)		1/6/21		0/2/26		11/17/0	

Table 163: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.5e−05	9.5e−06	−	3.0e−08	−	4.7e−05	+
	(3.9e−06)	(3.6e−06)		(3.3e−08)		(9.8e−06)	
f_2	8.1e+06	8.7e+06	·	1.3e+06	−	1.6e+07	+
	(1.4e+06)	(2.3e+06)		(6.6e+05)		(2.7e+06)	
f_3	3.2e+07	9.4e+06	−	2.6e+07	·	4.3e+08	+
	(1.2e+07)	(3.6e+06)		(3.0e+07)		(9.2e+07)	
f_4	3.5e+04	3.5e+04	·	1.0e+04	−	3.9e+04	+
	(4.2e+03)	(6.4e+03)		(4.3e+03)		(5.4e+03)	
f_5	5.5e−04	4.9e−04	·	2.5e−05	−	1.7e−03	+
	(1.2e−04)	(1.4e−04)		(1.7e−05)		(2.5e−04)	
f_6	1.3e+01	1.4e+01	+	2.9e+01	+	1.3e+01	·
	(7.9e−01)	(2.8e−01)		(2.1e+01)		(2.8e−01)	
f_7	2.8e+01	1.7e+01	−	2.0e+01	−	4.4e+01	+
	(3.5e+00)	(3.0e+00)		(1.2e+01)		(3.8e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.1e−02)	(5.2e−02)		(5.4e−02)		(5.3e−02)	
f_9	3.9e+01	3.9e+01	·	1.6e+01	−	3.9e+01	·
	(9.7e−01)	(1.3e+00)		(3.3e+00)		(1.1e+00)	
f_{10}	1.1e+00	1.1e+00	·	5.4e−02	−	3.2e+00	+
	(2.7e−02)	(4.1e−02)		(5.4e−02)		(3.5e−01)	
f_{11}	1.8e+02	1.4e+02	−	6.5e+01	−	1.9e+02	·
	(1.0e+01)	(1.1e+01)		(1.9e+01)		(1.1e+01)	
f_{12}	1.9e+02	1.9e+02	·	6.6e+01	−	2.0e+02	+
	(8.3e+00)	(1.2e+01)		(2.4e+01)		(9.6e+00)	
f_{13}	2.0e+02	1.9e+02	·	1.2e+02	−	2.1e+02	·
	(1.1e+01)	(9.8e+00)		(3.2e+01)		(1.2e+01)	
f_{14}	6.9e+03	5.1e+03	−	1.8e+03	−	6.9e+03	·
	(2.7e+02)	(3.0e+02)		(4.6e+02)		(2.9e+02)	
f_{15}	7.2e+03	7.2e+03	·	5.1e+03	−	7.2e+03	·
	(3.1e+02)	(3.3e+02)		(7.5e+02)		(2.8e+02)	
f_{16}	2.5e+00	2.5e+00	·	1.9e+00	−	2.4e+00	·
	(2.6e−01)	(2.7e−01)		(5.0e−01)		(2.7e−01)	
f_{17}	2.2e+02	1.8e+02	−	1.2e+02	−	2.3e+02	+
	(1.0e+01)	(9.4e+00)		(2.6e+01)		(1.1e+01)	
f_{18}	2.3e+02	2.2e+02	·	1.6e+02	−	2.4e+02	+
	(8.6e+00)	(1.1e+01)		(3.2e+01)		(1.1e+01)	
f_{19}	1.7e+01	1.5e+01	−	5.5e+00	−	1.8e+01	+
	(7.2e−01)	(8.7e−01)		(1.2e+00)		(8.9e−01)	
f_{20}	1.3e+01	1.3e+01	·	1.2e+01	−	1.3e+01	·
	(2.5e−01)	(2.1e−01)		(8.6e−01)		(2.7e−01)	
f_{21}	2.6e+02	2.8e+02	·	2.7e+02	·	2.6e+02	·
	(5.5e+01)	(7.2e+01)		(7.4e+01)		(6.1e+01)	
f_{22}	7.0e+03	5.6e+03	−	1.8e+03	−	7.0e+03	·
	(2.4e+02)	(3.6e+02)		(4.1e+02)		(2.5e+02)	
f_{23}	7.3e+03	7.2e+03	·	5.1e+03	−	7.2e+03	−
	(2.5e+02)	(3.2e+02)		(7.7e+02)		(2.8e+02)	
f_{24}	2.2e+02	2.1e+02	−	2.4e+02	+	2.5e+02	+
	(2.4e+00)	(2.4e+00)		(1.1e+01)		(3.2e+00)	
f_{25}	3.1e+02	2.7e+02	−	2.5e+02	−	3.1e+02	·
	(9.9e+00)	(1.2e+01)		(8.3e+00)		(6.2e+00)	
f_{26}	2.0e+02	2.0e+02	·	2.3e+02	−	2.0e+02	+
	(1.1e−01)	(1.2e−01)		(5.7e+01)		(1.9e−01)	
f_{27}	7.4e+02	8.4e+02	·	7.1e+02	·	1.2e+03	+
	(1.2e+02)	(2.0e+02)		(9.4e+01)		(5.6e+01)	
f_{28}	3.0e+02	3.0e+02	·	3.4e+02	−	3.0e+02	+
	(3.9e−02)	(3.5e−02)		(2.1e+02)		(4.5e−02)	
Summary (+/·/−)		1/17/10		2/4/22		15/12/1	

Table 164: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	1.3e−01	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(8.2e−01)		(0.0e+00)		(0.0e+00)	
f_2	1.1e+05	5.4e+06	+	4.3e+05	+	1.3e+06	+
	(6.1e+04)	(2.9e+06)		(2.8e+05)		(5.2e+05)	
f_3	5.8e+04	3.3e+08	+	7.5e+06	+	2.1e+08	+
	(3.2e+05)	(3.6e+08)		(1.9e+07)		(2.2e+08)	
f_4	4.5e+02	1.2e+04	+	1.9e+03	+	1.1e+04	+
	(1.6e+02)	(3.4e+03)		(7.7e+02)		(3.6e+03)	
f_5	0.0e+00	2.2e+01	+	0.0e+00	·	2.6e−07	+
	(0.0e+00)	(3.0e+01)		(0.0e+00)		(1.9e−07)	
f_6	4.4e+00	5.2e+01	+	8.5e+00	+	1.3e+01	+
	(9.0e+00)	(2.1e+01)		(8.7e+00)		(8.2e+00)	
f_7	8.2e+00	1.2e+01	·	2.2e+01	+	4.8e+01	+
	(6.9e+00)	(5.7e+00)		(1.6e+01)		(1.8e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.2e−02)	(4.3e−02)		(4.4e−02)		(5.4e−02)	
f_9	1.0e+01	9.8e+00	·	1.3e+01	+	2.7e+01	+
	(5.0e+00)	(2.2e+00)		(3.9e+00)		(1.0e+01)	
f_{10}	1.4e−02	1.2e+01	+	1.9e−02	·	6.3e−02	+
	(1.1e−02)	(7.6e+00)		(1.6e−02)		(8.0e−02)	
f_{11}	1.5e+02	3.4e+01	−	6.8e+01	−	2.0e+02	+
	(4.2e+01)	(1.5e+01)		(1.8e+01)		(1.3e+01)	
f_{12}	1.8e+02	4.0e+01	−	7.2e+01	−	2.2e+02	+
	(2.5e+01)	(3.8e+01)		(2.1e+01)		(1.3e+01)	
f_{13}	1.9e+02	5.2e+01	−	1.3e+02	−	2.1e+02	+
	(1.3e+01)	(3.4e+01)		(3.1e+01)		(1.7e+01)	
f_{14}	6.7e+03	4.4e+03	−	2.0e+03	−	6.9e+03	+
	(3.2e+02)	(4.1e+02)		(4.1e+02)		(2.6e+02)	
f_{15}	7.2e+03	6.9e+03	−	4.3e+03	−	7.2e+03	·
	(3.2e+02)	(3.3e+02)		(7.8e+02)		(3.2e+02)	
f_{16}	2.4e+00	2.5e+00	·	2.0e+00	−	2.4e+00	·
	(3.2e−01)	(2.7e−01)		(3.9e−01)		(2.9e−01)	
f_{17}	2.1e+02	1.3e+02	−	1.1e+02	−	2.3e+02	+
	(1.3e+01)	(8.0e+00)		(2.2e+01)		(1.7e+01)	
f_{18}	2.2e+02	1.9e+02	−	1.4e+02	−	2.5e+02	+
	(1.4e+01)	(7.5e+00)		(2.6e+01)		(1.7e+01)	
f_{19}	1.5e+01	6.4e+00	−	4.6e+00	−	1.7e+01	+
	(1.4e+00)	(2.3e+00)		(1.4e+00)		(1.6e+00)	
f_{20}	1.2e+01	1.2e+01	−	1.2e+01	−	1.3e+01	+
	(3.4e−01)	(3.7e−01)		(8.2e−01)		(3.0e−01)	
f_{21}	3.0e+02	3.1e+02	·	3.0e+02	+	2.9e+02	+
	(7.3e+01)	(7.2e+01)		(7.5e+01)		(5.8e+01)	
f_{22}	6.9e+03	4.4e+03	−	2.0e+03	−	7.1e+03	·
	(3.4e+02)	(5.2e+02)		(5.1e+02)		(3.5e+02)	
f_{23}	7.3e+03	6.7e+03	−	4.4e+03	−	7.4e+03	+
	(2.9e+02)	(4.6e+02)		(8.4e+02)		(3.4e+02)	
f_{24}	2.2e+02	2.2e+02	·	2.4e+02	+	2.5e+02	+
	(1.4e+01)	(7.1e+00)		(9.1e+00)		(8.8e+00)	
f_{25}	2.5e+02	2.5e+02	·	2.6e+02	·	2.6e+02	·
	(6.5e+00)	(4.8e+00)		(7.5e+00)		(7.2e+00)	
f_{26}	2.3e+02	2.0e+02	+	2.6e+02	+	2.6e+02	+
	(5.3e+01)	(1.4e−01)		(6.7e+01)		(7.1e+01)	
f_{27}	5.6e+02	5.3e+02	·	6.6e+02	+	7.6e+02	+
	(7.0e+01)	(9.7e+01)		(7.7e+01)		(1.3e+02)	
f_{28}	3.2e+02	3.7e+02	+	3.6e+02	+	3.9e+02	+
	(1.5e+02)	(8.7e+01)		(2.5e+02)		(3.0e+02)	
Summary (+/·/−)		8/9/11		11/5/12		22/6/0	

Table 165: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	6.9e+01	4.0e+00	−	1.3e+01	−	1.0e+02	+
	(1.4e+01)	(1.2e+00)		(4.8e+01)		(1.3e+01)	
f_2	6.3e+07	3.9e+07	−	1.5e+06	−	7.3e+07	+
	(1.1e+07)	(6.4e+06)		(8.2e+05)		(1.2e+07)	
f_3	4.5e+09	2.0e+09	−	1.1e+08	−	8.3e+09	+
	(6.7e+08)	(3.5e+08)		(1.4e+08)		(8.4e+08)	
f_4	5.6e+04	5.1e+04	·	1.4e+04	−	5.8e+04	·
	(8.0e+03)	(7.2e+03)		(3.8e+03)		(7.5e+03)	
f_5	1.6e+01	2.7e+00	−	3.2e+00	−	1.8e+01	+
	(2.3e+00)	(4.6e−01)		(1.0e+01)		(1.7e+00)	
f_6	7.9e+01	3.4e+01	−	2.8e+01	−	1.1e+02	+
	(8.7e+00)	(7.0e+00)		(2.2e+01)		(1.2e+01)	
f_7	7.8e+01	6.2e+01	−	3.4e+01	−	9.1e+01	+
	(6.4e+00)	(4.9e+00)		(1.1e+01)		(5.8e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.5e−02)	(6.0e−02)		(4.5e−02)		(4.8e−02)	
f_9	4.0e+01	3.9e+01	·	1.9e+01	−	4.0e+01	·
	(1.2e+00)	(1.2e+00)		(3.9e+00)		(1.2e+00)	
f_{10}	1.4e+02	3.1e+01	−	2.5e+00	−	2.2e+02	+
	(2.8e+01)	(5.7e+00)		(8.1e+00)		(2.7e+01)	
f_{11}	2.1e+02	1.7e+02	−	4.1e+01	−	2.2e+02	+
	(1.3e+01)	(1.2e+01)		(1.0e+01)		(1.2e+01)	
f_{12}	2.4e+02	2.2e+02	−	8.3e+01	−	2.4e+02	·
	(1.3e+01)	(1.2e+01)		(2.0e+01)		(1.5e+01)	
f_{13}	2.3e+02	2.2e+02	−	1.4e+02	−	2.5e+02	+
	(1.6e+01)	(1.5e+01)		(3.1e+01)		(1.2e+01)	
f_{14}	6.9e+03	5.3e+03	−	1.2e+03	−	7.0e+03	·
	(2.3e+02)	(3.3e+02)		(3.4e+02)		(2.5e+02)	
f_{15}	7.2e+03	7.3e+03	·	3.7e+03	−	7.3e+03	·
	(3.4e+02)	(2.8e+02)		(6.8e+02)		(3.1e+02)	
f_{16}	2.5e+00	2.5e+00	·	2.1e+00	−	2.4e+00	·
	(2.2e−01)	(2.3e−01)		(5.3e−01)		(3.0e−01)	
f_{17}	2.7e+02	2.2e+02	−	1.1e+02	−	3.0e+02	+
	(1.5e+01)	(1.2e+01)		(2.3e+01)		(1.7e+01)	
f_{18}	2.9e+02	2.5e+02	−	1.3e+02	−	3.2e+02	+
	(1.8e+01)	(1.2e+01)		(3.3e+01)		(1.3e+01)	
f_{19}	2.1e+01	1.8e+01	−	7.2e+00	−	2.7e+01	+
	(1.5e+00)	(1.0e+00)		(4.3e+00)		(1.7e+00)	
f_{20}	1.3e+01	1.3e+01	·	1.2e+01	−	1.3e+01	·
	(2.3e−01)	(2.3e−01)		(5.9e−01)		(2.1e−01)	
f_{21}	5.1e+02	3.6e+02	−	3.2e+02	−	8.2e+02	+
	(5.1e+01)	(6.0e+01)		(8.7e+01)		(2.7e+02)	
f_{22}	7.1e+03	5.7e+03	−	1.3e+03	−	7.1e+03	·
	(2.6e+02)	(3.2e+02)		(3.1e+02)		(2.9e+02)	
f_{23}	7.4e+03	7.4e+03	·	4.0e+03	−	7.4e+03	·
	(3.0e+02)	(2.6e+02)		(8.3e+02)		(3.2e+02)	
f_{24}	2.8e+02	2.6e+02	−	2.5e+02	−	2.9e+02	+
	(5.4e+00)	(4.6e+00)		(9.9e+00)		(3.0e+00)	
f_{25}	3.1e+02	3.1e+02	·	2.6e+02	−	3.2e+02	+
	(7.1e+00)	(6.7e+00)		(8.3e+00)		(3.6e+00)	
f_{26}	2.0e+02	2.0e+02	−	2.2e+02	−	2.1e+02	+
	(8.3e−01)	(5.8e−01)		(4.7e+01)		(1.1e+00)	
f_{27}	1.3e+03	1.2e+03	·	7.9e+02	−	1.3e+03	+
	(4.3e+01)	(6.3e+01)		(9.3e+01)		(3.3e+01)	
f_{28}	6.9e+02	4.2e+02	−	3.3e+02	−	7.9e+02	+
	(3.3e+01)	(1.5e+01)		(1.0e+02)		(3.1e+01)	
Summary (+/·/−)		0/9/19		0/1/27		18/10/0	

Table 166: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	4.6e−10	·	2.9e−10	·	6.1e+02	+
	(0.0e+00)	(2.3e−09)		(2.1e−09)		(1.9e+02)	
f_2	1.9e+05	4.0e+06	+	1.3e+06	+	4.7e+07	+
	(8.0e+04)	(1.2e+06)		(6.9e+05)		(1.7e+07)	
f_3	2.3e+01	2.0e+05	+	2.0e+07	+	1.7e+10	+
	(1.6e+02)	(1.0e+05)		(2.8e+07)		(5.3e+09)	
f_4	2.1e+03	2.6e+04	+	8.4e+03	+	3.3e+04	+
	(5.5e+02)	(4.0e+03)		(2.9e+03)		(6.1e+03)	
f_5	0.0e+00	2.9e−06	+	3.2e−06	+	5.6e+01	+
	(0.0e+00)	(9.2e−07)		(2.3e−06)		(1.2e+01)	
f_6	5.3e+00	1.4e+01	+	2.4e+01	+	1.1e+02	+
	(7.2e+00)	(3.1e+00)		(2.0e+01)		(2.8e+01)	
f_7	3.2e−01	6.0e+00	+	1.8e+01	+	1.2e+02	+
	(5.5e−01)	(1.3e+00)		(1.1e+01)		(2.5e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(6.0e−02)	(5.7e−02)		(5.0e−02)		(4.0e−02)	
f_9	3.6e+01	3.9e+01	·	1.6e+01	−	3.9e+01	·
	(7.3e+00)	(1.2e+00)		(4.4e+00)		(1.4e+00)	
f_{10}	1.9e−03	2.4e−01	+	2.2e−02	+	2.9e+02	+
	(3.8e−03)	(1.5e−01)		(1.6e−02)		(5.6e+01)	
f_{11}	1.7e+02	1.3e+02	−	6.1e+01	−	2.7e+02	+
	(9.3e+00)	(1.1e+01)		(1.4e+01)		(2.1e+01)	
f_{12}	1.9e+02	1.9e+02	·	6.0e+01	−	2.8e+02	+
	(7.2e+00)	(1.0e+01)		(2.2e+01)		(2.2e+01)	
f_{13}	1.8e+02	1.9e+02	·	1.2e+02	−	2.9e+02	+
	(1.1e+01)	(1.1e+01)		(3.4e+01)		(2.0e+01)	
f_{14}	6.8e+03	5.2e+03	−	1.9e+03	−	6.9e+03	·
	(2.3e+02)	(2.6e+02)		(4.8e+02)		(2.8e+02)	
f_{15}	7.2e+03	7.2e+03	·	4.8e+03	−	7.4e+03	·
	(2.3e+02)	(3.1e+02)		(7.6e+02)		(2.8e+02)	
f_{16}	2.5e+00	2.5e+00	·	2.0e+00	−	2.4e+00	·
	(2.4e−01)	(2.7e−01)		(5.2e−01)		(3.4e−01)	
f_{17}	2.1e+02	1.7e+02	−	1.1e+02	−	4.1e+02	+
	(9.5e+00)	(9.8e+00)		(2.4e+01)		(4.5e+01)	
f_{18}	2.2e+02	2.2e+02	·	1.5e+02	−	4.2e+02	+
	(8.8e+00)	(9.5e+00)		(2.9e+01)		(4.4e+01)	
f_{19}	1.6e+01	1.5e+01	·	5.5e+00	−	4.7e+01	+
	(1.1e+00)	(8.9e−01)		(1.7e+00)		(1.9e+01)	
f_{20}	1.2e+01	1.2e+01	+	1.2e+01	−	1.3e+01	+
	(2.6e−01)	(2.4e−01)		(6.9e−01)		(3.0e−01)	
f_{21}	2.9e+02	2.9e+02	+	2.9e+02	+	7.9e+02	+
	(8.1e+01)	(8.0e+01)		(6.8e+01)		(1.9e+02)	
f_{22}	6.8e+03	5.5e+03	−	1.9e+03	−	7.2e+03	·
	(2.7e+02)	(3.5e+02)		(4.3e+02)		(3.6e+02)	
f_{23}	7.2e+03	7.1e+03	·	5.0e+03	−	7.5e+03	·
	(3.7e+02)	(2.9e+02)		(8.3e+02)		(3.4e+02)	
f_{24}	2.0e+02	2.0e+02	+	2.4e+02	+	2.9e+02	+
	(9.8e+00)	(1.2e+00)		(9.7e+00)		(9.3e+00)	
f_{25}	2.4e+02	2.5e+02	+	2.5e+02	+	2.9e+02	+
	(5.4e+00)	(8.5e+00)		(7.9e+00)		(1.2e+01)	
f_{26}	2.2e+02	2.0e+02	+	2.4e+02	+	2.6e+02	+
	(3.9e+01)	(4.1e−02)		(6.4e+01)		(8.5e+01)	
f_{27}	3.6e+02	5.5e+02	+	7.0e+02	+	1.3e+03	+
	(1.0e+02)	(2.1e+02)		(7.8e+01)		(7.4e+01)	
f_{28}	3.2e+02	3.0e+02	+	3.4e+02	+	1.4e+03	+
	(1.4e+02)	(1.0e−03)		(2.0e+02)		(2.1e+02)	
Summary (+/·/−)		14/10/4		13/2/13		21/7/0	

Table 167: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.0e+03	1.1e+03	·	9.5e+02	·	4.4e+03	+
	(2.2e+02)	(2.0e+02)		(6.9e+02)		(4.3e+02)	
f_2	1.1e+08	1.1e+08	·	5.4e+06	−	1.5e+08	+
	(2.5e+07)	(2.2e+07)		(5.9e+06)		(2.8e+07)	
f_3	1.5e+10	1.5e+10	·	1.5e+09	−	2.4e+10	+
	(2.0e+09)	(2.4e+09)		(2.0e+09)		(3.3e+09)	
f_4	6.7e+04	6.8e+04	·	2.6e+04	−	6.9e+04	·
	(9.0e+03)	(9.3e+03)		(1.0e+04)		(8.9e+03)	
f_5	1.3e+02	1.3e+02	·	1.0e+02	·	2.3e+02	+
	(1.8e+01)	(1.5e+01)		(1.2e+02)		(2.1e+01)	
f_6	2.0e+02	2.0e+02	·	1.0e+02	−	4.1e+02	+
	(1.8e+01)	(1.6e+01)		(3.7e+01)		(5.1e+01)	
f_7	1.1e+02	1.1e+02	·	6.6e+01	−	1.5e+02	+
	(9.5e+00)	(8.8e+00)		(2.4e+01)		(1.2e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.4e−02)	(5.8e−02)		(5.2e−02)		(5.0e−02)	
f_9	3.9e+01	3.9e+01	·	2.6e+01	−	3.9e+01	·
	(1.1e+00)	(1.4e+00)		(4.2e+00)		(1.1e+00)	
f_{10}	5.2e+02	5.2e+02	·	1.5e+02	−	1.0e+03	+
	(8.6e+01)	(7.0e+01)		(1.3e+02)		(1.4e+02)	
f_{11}	2.1e+02	2.1e+02	·	9.9e+01	−	2.8e+02	+
	(1.1e+01)	(1.4e+01)		(2.3e+01)		(1.4e+01)	
f_{12}	2.6e+02	2.6e+02	·	1.7e+02	−	3.1e+02	+
	(1.8e+01)	(2.1e+01)		(2.9e+01)		(1.3e+01)	
f_{13}	2.7e+02	2.6e+02	·	1.9e+02	−	3.1e+02	+
	(1.4e+01)	(1.8e+01)		(3.3e+01)		(1.2e+01)	
f_{14}	5.3e+03	5.3e+03	·	2.0e+03	−	7.0e+03	+
	(2.7e+02)	(3.1e+02)		(4.5e+02)		(3.2e+02)	
f_{15}	7.3e+03	7.4e+03	·	5.8e+03	−	7.4e+03	·
	(2.9e+02)	(2.4e+02)		(5.1e+02)		(3.1e+02)	
f_{16}	2.4e+00	2.4e+00	·	2.1e+00	−	2.4e+00	·
	(2.6e−01)	(2.9e−01)		(3.5e−01)		(3.0e−01)	
f_{17}	3.3e+02	3.3e+02	·	2.1e+02	−	6.2e+02	+
	(2.6e+01)	(2.2e+01)		(5.2e+01)		(4.4e+01)	
f_{18}	3.4e+02	3.5e+02	·	3.0e+02	−	6.3e+02	+
	(2.4e+01)	(2.3e+01)		(6.6e+01)		(3.9e+01)	
f_{19}	3.8e+01	3.8e+01	·	3.8e+01	−	3.9e+02	+
	(6.3e+00)	(5.7e+00)		(9.1e+01)		(1.1e+02)	
f_{20}	1.3e+01	1.3e+01	·	1.2e+01	−	1.3e+01	·
	(2.2e−01)	(2.5e−01)		(6.0e−01)		(2.6e−01)	
f_{21}	1.0e+03	9.9e+02	·	7.3e+02	−	1.7e+03	+
	(1.3e+02)	(1.5e+02)		(2.6e+02)		(1.3e+02)	
f_{22}	5.9e+03	5.8e+03	·	2.1e+03	−	7.4e+03	+
	(3.6e+02)	(3.4e+02)		(4.4e+02)		(2.3e+02)	
f_{23}	7.7e+03	7.6e+03	·	6.1e+03	−	7.6e+03	·
	(2.7e+02)	(2.7e+02)		(5.7e+02)		(3.8e+02)	
f_{24}	2.9e+02	2.9e+02	·	2.6e+02	−	3.1e+02	+
	(4.6e+00)	(5.6e+00)		(1.1e+01)		(3.1e+00)	
f_{25}	3.2e+02	3.2e+02	·	2.7e+02	−	3.3e+02	+
	(3.4e+00)	(3.6e+00)		(1.0e+01)		(3.5e+00)	
f_{26}	2.1e+02	2.1e+02	·	2.0e+02	−	2.1e+02	+
	(1.9e+00)	(1.7e+00)		(5.0e−01)		(2.4e+00)	
f_{27}	1.3e+03	1.3e+03	·	9.5e+02	−	1.4e+03	+
	(3.4e+01)	(3.0e+01)		(1.0e+02)		(3.0e+01)	
f_{28}	1.5e+03	1.5e+03	·	1.0e+03	−	2.0e+03	+
	(6.7e+01)	(8.3e+01)		(3.2e+02)		(6.5e+01)	
Summary (+/·/−)		0/28/0		0/3/25		21/7/0	

Table 168: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.6e+04	1.1e+04	−	4.2e+03	−	1.5e+04	·
	(1.5e+03)	(1.5e+03)		(1.3e+03)		(1.8e+03)	
f_2	2.8e+08	2.4e+08	−	6.0e+07	−	2.7e+08	·
	(4.2e+07)	(4.0e+07)		(2.7e+07)		(5.3e+07)	
f_3	6.7e+10	5.3e+10	−	1.6e+10	−	7.6e+10	·
	(1.2e+10)	(9.5e+09)		(9.1e+09)		(1.6e+10)	
f_4	7.3e+04	7.3e+04	·	4.4e+04	−	7.2e+04	·
	(9.5e+03)	(8.6e+03)		(1.2e+04)		(1.1e+04)	
f_5	1.6e+03	1.3e+03	−	5.9e+02	−	1.5e+03	·
	(1.9e+02)	(2.0e+02)		(4.4e+02)		(1.9e+02)	
f_6	1.3e+03	9.4e+02	−	3.0e+02	−	1.4e+03	·
	(1.9e+02)	(1.7e+02)		(1.1e+02)		(1.9e+02)	
f_7	2.4e+02	2.1e+02	−	1.2e+02	−	2.7e+02	+
	(2.9e+01)	(2.0e+01)		(2.8e+01)		(2.8e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(5.0e−02)	(4.6e−02)		(5.1e−02)		(5.1e−02)	
f_9	4.0e+01	3.9e+01	·	3.1e+01	−	4.0e+01	·
	(9.5e−01)	(9.9e−01)		(3.5e+00)		(1.0e+00)	
f_{10}	2.6e+03	2.1e+03	−	7.3e+02	−	2.8e+03	·
	(3.0e+02)	(3.0e+02)		(2.5e+02)		(2.7e+02)	
f_{11}	3.9e+02	3.3e+02	−	1.5e+02	−	4.0e+02	·
	(2.1e+01)	(2.5e+01)		(3.5e+01)		(1.8e+01)	
f_{12}	4.4e+02	4.0e+02	−	2.6e+02	−	4.5e+02	·
	(2.6e+01)	(2.8e+01)		(3.8e+01)		(2.0e+01)	
f_{13}	4.4e+02	4.0e+02	−	2.6e+02	−	4.5e+02	·
	(3.0e+01)	(3.2e+01)		(3.9e+01)		(2.7e+01)	
f_{14}	7.1e+03	5.4e+03	−	2.0e+03	−	7.1e+03	·
	(2.2e+02)	(3.3e+02)		(3.5e+02)		(2.3e+02)	
f_{15}	7.4e+03	7.4e+03	·	6.2e+03	−	7.4e+03	·
	(2.1e+02)	(2.7e+02)		(5.5e+02)		(2.6e+02)	
f_{16}	2.4e+00	2.5e+00	·	2.3e+00	·	2.5e+00	·
	(2.8e−01)	(3.1e−01)		(3.4e−01)		(2.5e−01)	
f_{17}	1.0e+03	8.1e+02	−	3.9e+02	−	1.0e+03	·
	(6.4e+01)	(5.9e+01)		(7.5e+01)		(6.6e+01)	
f_{18}	1.0e+03	8.1e+02	−	4.6e+02	−	1.0e+03	·
	(7.3e+01)	(7.3e+01)		(7.9e+01)		(6.2e+01)	
f_{19}	1.2e+04	6.8e+03	−	1.3e+03	−	1.1e+04	·
	(3.7e+03)	(3.2e+03)		(2.2e+03)		(3.5e+03)	
f_{20}	1.4e+01	1.4e+01	·	1.3e+01	−	1.4e+01	·
	(1.9e−01)	(1.7e−01)		(5.5e−01)		(2.2e−01)	
f_{21}	2.5e+03	2.3e+03	−	1.4e+03	−	2.5e+03	·
	(1.2e+02)	(1.3e+02)		(3.7e+02)		(1.5e+02)	
f_{22}	7.7e+03	6.1e+03	−	2.2e+03	−	7.5e+03	·
	(2.4e+02)	(4.2e+02)		(4.9e+02)		(2.8e+02)	
f_{23}	8.0e+03	7.9e+03	·	6.7e+03	−	7.9e+03	·
	(2.8e+02)	(2.5e+02)		(4.6e+02)		(3.2e+02)	
f_{24}	3.2e+02	3.1e+02	−	2.8e+02	−	3.2e+02	·
	(3.6e+00)	(3.8e+00)		(1.1e+01)		(4.1e+00)	
f_{25}	3.4e+02	3.3e+02	−	2.9e+02	−	3.4e+02	+
	(3.4e+00)	(3.9e+00)		(7.3e+00)		(4.3e+00)	
f_{26}	2.3e+02	2.2e+02	·	2.0e+02	−	2.3e+02	·
	(5.3e+00)	(5.2e+00)		(2.3e+00)		(5.0e+00)	
f_{27}	1.4e+03	1.4e+03	·	1.1e+03	−	1.4e+03	·
	(2.8e+01)	(3.4e+01)		(8.1e+01)		(3.8e+01)	
f_{28}	3.1e+03	2.9e+03	−	1.9e+03	−	3.2e+03	·
	(1.2e+02)	(1.2e+02)		(3.0e+02)		(1.7e+02)	
Summary (+/·/−)		0/9/19		0/2/26		2/26/0	

Table 169: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.0e−07	2.5e−04	+	1.2e−07	·	1.8e+02	+
	(9.9e−08)	(8.2e−05)		(1.4e−07)		(4.8e+01)	
f_2	1.3e+06	1.2e+07	+	1.4e+06	·	4.8e+07	+
	(8.2e+05)	(2.8e+06)		(7.9e+05)		(1.3e+07)	
f_3	3.7e+07	4.7e+07	+	5.1e+07	·	1.1e+10	+
	(4.2e+07)	(1.7e+07)		(6.2e+07)		(2.4e+09)	
f_4	9.8e+03	3.9e+04	+	1.1e+04	·	3.4e+04	+
	(3.2e+03)	(6.0e+03)		(4.5e+03)		(7.0e+03)	
f_5	7.5e−05	3.8e−03	+	7.1e−05	·	2.6e+01	+
	(6.6e−05)	(9.2e−04)		(4.6e−05)		(4.7e+00)	
f_6	2.0e+01	1.5e+01	·	2.5e+01	·	7.4e+01	+
	(1.4e+01)	(3.7e−01)		(2.0e+01)		(2.0e+01)	
f_7	2.2e+01	2.5e+01	·	2.2e+01	·	9.8e+01	+
	(1.5e+01)	(3.5e+00)		(1.2e+01)		(1.1e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.9e−02)	(5.9e−02)		(4.5e−02)		(4.9e−02)	
f_9	1.7e+01	3.9e+01	+	1.6e+01	·	3.9e+01	+
	(4.5e+00)	(1.2e+00)		(4.7e+00)		(1.3e+00)	
f_{10}	1.1e−01	1.5e+00	+	7.0e−02	·	2.1e+02	+
	(1.6e−01)	(1.3e−01)		(6.2e−02)		(3.5e+01)	
f_{11}	5.9e+01	1.4e+02	+	5.9e+01	·	2.4e+02	+
	(1.5e+01)	(1.1e+01)		(1.6e+01)		(1.6e+01)	
f_{12}	7.2e+01	2.0e+02	+	6.7e+01	·	2.6e+02	+
	(2.3e+01)	(1.1e+01)		(2.2e+01)		(1.5e+01)	
f_{13}	1.2e+02	1.9e+02	+	1.2e+02	·	2.6e+02	+
	(3.3e+01)	(1.1e+01)		(3.1e+01)		(1.6e+01)	
f_{14}	1.8e+03	5.2e+03	+	1.8e+03	·	6.8e+03	+
	(3.7e+02)	(3.7e+02)		(3.4e+02)		(3.2e+02)	
f_{15}	5.2e+03	7.3e+03	+	5.0e+03	·	7.3e+03	+
	(7.0e+02)	(2.8e+02)		(7.1e+02)		(2.6e+02)	
f_{16}	2.0e+00	2.5e+00	+	2.0e+00	·	2.4e+00	+
	(4.2e−01)	(2.7e−01)		(4.1e−01)		(3.1e−01)	
f_{17}	1.1e+02	1.8e+02	+	1.2e+02	·	3.4e+02	+
	(1.8e+01)	(1.0e+01)		(2.6e+01)		(2.7e+01)	
f_{18}	1.5e+02	2.3e+02	+	1.5e+02	·	3.6e+02	+
	(2.9e+01)	(1.1e+01)		(2.9e+01)		(1.9e+01)	
f_{19}	5.5e+00	1.6e+01	+	5.7e+00	·	3.0e+01	+
	(1.6e+00)	(1.1e+00)		(1.5e+00)		(3.1e+00)	
f_{20}	1.2e+01	1.3e+01	+	1.2e+01	·	1.3e+01	+
	(6.6e−01)	(2.2e−01)		(6.9e−01)		(2.4e−01)	
f_{21}	3.0e+02	2.9e+02	·	2.8e+02	·	5.3e+02	+
	(7.1e+01)	(6.3e+01)		(6.7e+01)		(9.8e+01)	
f_{22}	1.8e+03	5.7e+03	+	1.9e+03	·	7.2e+03	+
	(4.1e+02)	(3.6e+02)		(4.8e+02)		(2.8e+02)	
f_{23}	5.3e+03	7.3e+03	+	5.2e+03	·	7.5e+03	+
	(6.2e+02)	(3.1e+02)		(8.9e+02)		(3.4e+02)	
f_{24}	2.4e+02	2.2e+02	−	2.4e+02	·	2.9e+02	+
	(9.7e+00)	(3.7e+00)		(8.0e+00)		(7.7e+00)	
f_{25}	2.6e+02	2.8e+02	+	2.6e+02	·	2.9e+02	+
	(7.6e+00)	(1.7e+01)		(1.0e+01)		(1.4e+01)	
f_{26}	2.2e+02	2.0e+02	+	2.2e+02	·	2.2e+02	+
	(5.3e+01)	(1.4e−01)		(4.8e+01)		(5.7e+01)	
f_{27}	7.1e+02	9.1e+02	+	6.8e+02	·	1.3e+03	+
	(9.2e+01)	(1.8e+02)		(1.0e+02)		(6.8e+01)	
f_{28}	3.0e+02	3.0e+02	+	3.2e+02	·	9.6e+02	+
	(1.0e−02)	(1.7e−01)		(1.6e+02)		(1.3e+02)	
Summary (+/·/−)		23/4/1		0/28/0		27/1/0	

Table 170: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.1e+04	6.2e+03	−	2.6e+03	−	1.2e+04	+
	(1.6e+03)	(7.3e+02)		(1.4e+03)		(1.4e+03)	
f_2	2.0e+08	1.7e+08	−	3.4e+07	−	2.1e+08	·
	(4.5e+07)	(3.3e+07)		(2.4e+07)		(4.1e+07)	
f_3	3.8e+10	3.2e+10	−	6.8e+09	−	3.9e+10	·
	(6.9e+09)	(3.7e+09)		(4.8e+09)		(8.6e+09)	
f_4	5.9e+04	7.2e+04	+	3.3e+04	−	5.8e+04	·
	(8.9e+03)	(1.1e+04)		(1.2e+04)		(7.9e+03)	
f_5	9.2e+02	5.4e+02	−	3.9e+02	−	8.6e+02	·
	(1.7e+02)	(6.9e+01)		(3.7e+02)		(1.8e+02)	
f_6	8.0e+02	5.0e+02	−	2.0e+02	−	8.9e+02	·
	(1.4e+02)	(7.4e+01)		(5.6e+01)		(1.6e+02)	
f_7	1.8e+02	1.6e+02	−	8.9e+01	−	1.9e+02	·
	(2.2e+01)	(1.4e+01)		(2.5e+01)		(2.3e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.2e−02)	(4.0e−02)		(5.3e−02)		(4.5e−02)	
f_9	4.0e+01	3.9e+01	·	3.0e+01	−	3.9e+01	·
	(1.0e+00)	(1.0e+00)		(4.3e+00)		(1.1e+00)	
f_{10}	1.6e+03	1.4e+03	·	4.3e+02	−	1.8e+03	+
	(2.8e+02)	(1.9e+02)		(2.0e+02)		(2.4e+02)	
f_{11}	3.4e+02	2.7e+02	−	1.3e+02	−	3.6e+02	·
	(2.9e+01)	(1.4e+01)		(2.9e+01)		(2.4e+01)	
f_{12}	3.9e+02	3.3e+02	−	2.3e+02	−	3.9e+02	·
	(2.9e+01)	(2.0e+01)		(4.0e+01)		(3.0e+01)	
f_{13}	3.8e+02	3.4e+02	−	2.4e+02	−	4.0e+02	+
	(2.6e+01)	(1.9e+01)		(3.4e+01)		(2.8e+01)	
f_{14}	6.7e+03	5.3e+03	−	2.0e+03	−	7.1e+03	+
	(5.1e+02)	(3.3e+02)		(3.8e+02)		(2.5e+02)	
f_{15}	7.4e+03	7.4e+03	·	6.1e+03	−	7.4e+03	·
	(2.3e+02)	(2.8e+02)		(4.5e+02)		(2.3e+02)	
f_{16}	2.4e+00	2.5e+00	·	2.3e+00	·	2.4e+00	·
	(2.7e−01)	(2.7e−01)		(3.7e−01)		(2.5e−01)	
f_{17}	8.7e+02	6.2e+02	−	3.4e+02	−	9.2e+02	·
	(1.2e+02)	(4.8e+01)		(8.6e+01)		(1.1e+02)	
f_{18}	8.7e+02	6.1e+02	−	3.6e+02	−	9.5e+02	+
	(1.1e+02)	(5.2e+01)		(6.2e+01)		(1.2e+02)	
f_{19}	3.5e+03	1.1e+03	−	3.6e+02	−	4.7e+03	·
	(1.9e+03)	(5.8e+02)		(4.6e+02)		(2.6e+03)	
f_{20}	1.4e+01	1.4e+01	·	1.3e+01	−	1.4e+01	·
	(2.7e−01)	(1.9e−01)		(6.1e−01)		(2.7e−01)	
f_{21}	2.0e+03	1.8e+03	−	1.1e+03	−	2.1e+03	·
	(2.7e+02)	(1.4e+02)		(2.7e+02)		(2.3e+02)	
f_{22}	7.2e+03	6.0e+03	−	2.3e+03	−	7.5e+03	·
	(4.1e+02)	(3.9e+02)		(5.3e+02)		(3.0e+02)	
f_{23}	7.8e+03	7.7e+03	·	6.6e+03	−	7.8e+03	·
	(3.0e+02)	(3.3e+02)		(5.1e+02)		(2.7e+02)	
f_{24}	3.1e+02	3.1e+02	−	2.8e+02	−	3.1e+02	·
	(3.9e+00)	(4.0e+00)		(9.4e+00)		(4.0e+00)	
f_{25}	3.3e+02	3.3e+02	·	2.9e+02	−	3.3e+02	·
	(4.6e+00)	(4.0e+00)		(8.9e+00)		(4.1e+00)	
f_{26}	2.2e+02	2.2e+02	·	2.0e+02	−	2.2e+02	·
	(3.4e+00)	(3.0e+00)		(1.6e+00)		(4.4e+00)	
f_{27}	1.4e+03	1.3e+03	−	1.1e+03	−	1.4e+03	·
	(3.2e+01)	(3.7e+01)		(8.1e+01)		(3.2e+01)	
f_{28}	2.6e+03	2.3e+03	−	1.6e+03	−	2.8e+03	·
	(1.6e+02)	(8.6e+01)		(2.3e+02)		(1.6e+02)	
Summary (+/·/−)		1/9/18		0/2/26		5/23/0	

Table 171: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	3.5e+02	4.3e+02	+	4.4e+02	·	2.8e+03	+
	(6.5e+01)	(7.3e+01)		(4.7e+02)		(2.8e+02)	
f_2	8.9e+07	9.2e+07	·	2.7e+06	−	1.4e+08	+
	(1.6e+07)	(1.9e+07)		(1.8e+06)		(2.5e+07)	
f_3	1.0e+10	1.0e+10	·	7.7e+08	−	2.1e+10	+
	(1.5e+09)	(1.7e+09)		(1.3e+09)		(2.6e+09)	
f_4	6.4e+04	6.6e+04	·	2.3e+04	−	6.5e+04	·
	(8.0e+03)	(7.5e+03)		(1.0e+04)		(9.2e+03)	
f_5	6.1e+01	7.0e+01	+	4.6e+01	−	1.5e+02	+
	(9.0e+00)	(1.0e+01)		(6.8e+01)		(1.2e+01)	
f_6	1.4e+02	1.6e+02	·	7.7e+01	−	3.3e+02	+
	(1.5e+01)	(1.2e+01)		(3.5e+01)		(3.6e+01)	
f_7	9.9e+01	1.0e+02	·	4.7e+01	−	1.3e+02	+
	(7.8e+00)	(8.4e+00)		(1.9e+01)		(1.2e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.5e−02)	(5.0e−02)		(4.4e−02)		(5.6e−02)	
f_9	3.9e+01	3.9e+01	·	2.4e+01	−	4.0e+01	·
	(1.1e+00)	(1.3e+00)		(4.1e+00)		(9.6e−01)	
f_{10}	2.7e+02	3.1e+02	·	7.6e+01	−	8.3e+02	+
	(5.3e+01)	(5.9e+01)		(7.5e+01)		(1.1e+02)	
f_{11}	2.1e+02	2.0e+02	·	9.4e+01	−	2.6e+02	+
	(1.5e+01)	(1.5e+01)		(2.3e+01)		(1.3e+01)	
f_{12}	2.4e+02	2.4e+02	·	1.5e+02	−	3.0e+02	+
	(1.4e+01)	(1.4e+01)		(3.4e+01)		(1.4e+01)	
f_{13}	2.4e+02	2.5e+02	·	1.8e+02	−	3.0e+02	+
	(1.6e+01)	(1.5e+01)		(3.0e+01)		(1.4e+01)	
f_{14}	7.0e+03	5.2e+03	−	2.0e+03	−	7.0e+03	·
	(2.7e+02)	(4.0e+02)		(3.7e+02)		(2.5e+02)	
f_{15}	7.4e+03	7.4e+03	·	5.8e+03	−	7.4e+03	·
	(2.4e+02)	(2.3e+02)		(5.4e+02)		(2.3e+02)	
f_{16}	2.5e+00	2.4e+00	·	2.2e+00	−	2.5e+00	·
	(2.8e−01)	(3.5e−01)		(4.4e−01)		(2.9e−01)	
f_{17}	2.9e+02	2.9e+02	·	1.9e+02	−	5.4e+02	+
	(2.0e+01)	(1.7e+01)		(4.1e+01)		(3.2e+01)	
f_{18}	3.0e+02	3.0e+02	·	2.5e+02	−	5.4e+02	+
	(1.7e+01)	(1.7e+01)		(5.1e+01)		(3.0e+01)	
f_{19}	2.4e+01	2.5e+01	·	2.9e+01	−	1.9e+02	+
	(1.8e+00)	(2.2e+00)		(6.7e+01)		(6.2e+01)	
f_{20}	1.3e+01	1.3e+01	·	1.2e+01	−	1.3e+01	·
	(2.9e−01)	(1.7e−01)		(6.2e−01)		(2.4e−01)	
f_{21}	7.3e+02	7.9e+02	·	5.3e+02	−	1.5e+03	+
	(1.2e+02)	(1.1e+02)		(2.0e+02)		(1.7e+02)	
f_{22}	7.3e+03	5.8e+03	−	2.1e+03	−	7.4e+03	·
	(3.3e+02)	(3.0e+02)		(3.8e+02)		(3.2e+02)	
f_{23}	7.6e+03	7.5e+03	·	5.9e+03	−	7.7e+03	·
	(2.6e+02)	(2.8e+02)		(6.3e+02)		(2.4e+02)	
f_{24}	2.9e+02	2.9e+02	·	2.6e+02	−	3.1e+02	+
	(7.0e+00)	(6.4e+00)		(1.1e+01)		(3.1e+00)	
f_{25}	3.2e+02	3.2e+02	·	2.7e+02	−	3.3e+02	+
	(3.1e+00)	(3.5e+00)		(1.1e+01)		(3.2e+00)	
f_{26}	2.1e+02	2.1e+02	·	2.0e+02	−	2.1e+02	+
	(1.2e+00)	(1.5e+00)		(2.0e+01)		(2.1e+00)	
f_{27}	1.3e+03	1.3e+03	·	9.0e+02	−	1.3e+03	+
	(4.2e+01)	(4.5e+01)		(1.0e+02)		(2.7e+01)	
f_{28}	1.1e+03	1.2e+03	+	8.4e+02	−	1.8e+03	+
	(5.9e+01)	(5.9e+01)		(3.0e+02)		(7.1e+01)	
Summary (+/·/−)		3/23/2		0/2/26		19/9/0	

Table 172: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	3.7e−04	+	1.3e−07	+	3.5e+03	+
	(0.0e+00)	(1.2e−04)		(8.9e−08)		(9.9e+02)	
f_2	9.1e+05	1.2e+07	+	1.2e+06	·	7.4e+07	+
	(4.6e+05)	(2.5e+06)		(7.4e+05)		(2.1e+07)	
f_3	1.1e+07	5.6e+07	+	5.1e+07	+	2.5e+10	+
	(1.6e+07)	(1.8e+07)		(6.3e+07)		(7.2e+09)	
f_4	7.7e+03	3.9e+04	+	1.1e+04	+	3.9e+04	+
	(2.7e+03)	(6.5e+03)		(4.1e+03)		(7.2e+03)	
f_5	4.1e−07	5.4e−03	+	6.6e−05	+	1.7e+02	+
	(3.0e−07)	(1.1e−03)		(4.5e−05)		(3.1e+01)	
f_6	1.7e+01	1.6e+01	+	2.8e+01	+	2.8e+02	+
	(1.3e+01)	(2.7e+00)		(2.2e+01)		(7.9e+01)	
f_7	1.4e+01	2.7e+01	+	2.0e+01	·	1.5e+02	+
	(8.8e+00)	(3.8e+00)		(1.4e+01)		(2.5e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.9e−02)	(4.9e−02)		(5.1e−02)		(5.6e−02)	
f_9	1.4e+01	3.9e+01	+	1.6e+01	·	3.9e+01	+
	(3.3e+00)	(1.1e+00)		(4.0e+00)		(1.4e+00)	
f_{10}	2.3e−02	1.5e+00	+	6.9e−02	+	7.0e+02	+
	(1.7e−02)	(1.7e−01)		(8.9e−02)		(1.4e+02)	
f_{11}	3.8e+01	1.5e+02	+	6.1e+01	+	3.0e+02	+
	(1.2e+01)	(1.1e+01)		(1.7e+01)		(2.5e+01)	
f_{12}	4.8e+01	2.0e+02	+	6.5e+01	+	3.2e+02	+
	(1.6e+01)	(1.2e+01)		(2.1e+01)		(2.7e+01)	
f_{13}	1.4e+02	2.0e+02	+	1.2e+02	·	3.2e+02	+
	(4.8e+01)	(8.5e+00)		(2.8e+01)		(3.1e+01)	
f_{14}	5.5e+03	5.2e+03	·	1.8e+03	−	7.0e+03	+
	(1.8e+03)	(2.6e+02)		(4.9e+02)		(2.6e+02)	
f_{15}	7.2e+03	7.2e+03	·	5.1e+03	−	7.3e+03	·
	(3.9e+02)	(3.1e+02)		(7.1e+02)		(2.8e+02)	
f_{16}	2.5e+00	2.5e+00	·	2.1e+00	−	2.4e+00	·
	(3.2e−01)	(2.8e−01)		(4.9e−01)		(3.4e−01)	
f_{17}	1.7e+02	1.9e+02	·	1.1e+02	−	5.8e+02	+
	(5.1e+01)	(8.5e+00)		(1.8e+01)		(8.1e+01)	
f_{18}	2.4e+02	2.3e+02	−	1.5e+02	−	5.9e+02	+
	(1.4e+01)	(1.1e+01)		(3.4e+01)		(8.3e+01)	
f_{19}	4.0e+00	1.6e+01	+	5.7e+00	+	2.9e+02	+
	(2.3e+00)	(1.0e+00)		(1.7e+00)		(1.6e+02)	
f_{20}	1.3e+01	1.3e+01	·	1.2e+01	−	1.3e+01	+
	(3.4e−01)	(2.8e−01)		(6.2e−01)		(3.4e−01)	
f_{21}	3.0e+02	2.8e+02	·	2.8e+02	+	1.2e+03	+
	(7.7e+01)	(6.8e+01)		(6.6e+01)		(2.9e+02)	
f_{22}	4.9e+03	5.6e+03	·	1.9e+03	−	7.2e+03	+
	(2.2e+03)	(3.5e+02)		(4.5e+02)		(3.2e+02)	
f_{23}	7.3e+03	7.3e+03	·	5.1e+03	−	7.7e+03	+
	(3.9e+02)	(2.7e+02)		(8.6e+02)		(3.0e+02)	
f_{24}	2.3e+02	2.2e+02	−	2.4e+02	+	3.0e+02	+
	(1.3e+01)	(3.2e+00)		(1.1e+01)		(6.8e+00)	
f_{25}	2.5e+02	2.8e+02	+	2.6e+02	·	3.1e+02	+
	(6.1e+00)	(1.6e+01)		(9.2e+00)		(1.0e+01)	
f_{26}	2.2e+02	2.0e+02	+	2.4e+02	+	2.4e+02	+
	(4.3e+01)	(1.6e−01)		(6.3e+01)		(6.9e+01)	
f_{27}	6.4e+02	9.2e+02	+	6.9e+02	·	1.3e+03	+
	(6.8e+01)	(1.9e+02)		(1.1e+02)		(5.0e+01)	
f_{28}	3.4e+02	3.0e+02	+	3.0e+02	+	2.0e+03	+
	(2.1e+02)	(1.9e−01)		(8.8e−03)		(1.6e+02)	
Summary (+/·/−)		17/9/2		13/7/8		25/3/0	

Table 173: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	2.7e+03	9.9e+02	−	1.1e+03	−	4.2e+03	+
	(4.2e+02)	(1.8e+02)		(8.1e+02)		(4.7e+02)	
f_2	1.4e+08	1.1e+08	−	5.2e+06	−	1.6e+08	+
	(2.5e+07)	(2.0e+07)		(4.8e+06)		(2.8e+07)	
f_3	2.0e+10	1.4e+10	−	1.6e+09	−	2.6e+10	+
	(2.6e+09)	(2.1e+09)		(1.5e+09)		(3.9e+09)	
f_4	6.7e+04	6.6e+04	·	2.6e+04	−	7.1e+04	·
	(6.1e+03)	(8.7e+03)		(1.0e+04)		(7.1e+03)	
f_5	2.3e+02	1.3e+02	−	8.4e+01	−	2.2e+02	·
	(2.1e+01)	(1.5e+01)		(9.0e+01)		(1.9e+01)	
f_6	2.8e+02	2.0e+02	−	1.1e+02	−	4.2e+02	+
	(3.3e+01)	(1.7e+01)		(4.3e+01)		(4.6e+01)	
f_7	1.3e+02	1.1e+02	−	6.0e+01	−	1.5e+02	+
	(1.0e+01)	(1.1e+01)		(2.1e+01)		(1.3e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(6.0e−02)	(6.6e−02)		(5.7e−02)		(4.7e−02)	
f_9	3.9e+01	3.9e+01	·	2.7e+01	−	3.9e+01	·
	(1.2e+00)	(1.2e+00)		(3.9e+00)		(9.9e−01)	
f_{10}	8.7e+02	4.8e+02	−	1.4e+02	−	1.1e+03	+
	(1.2e+02)	(7.7e+01)		(1.1e+02)		(1.2e+02)	
f_{11}	2.4e+02	2.1e+02	−	1.0e+02	−	2.8e+02	+
	(1.3e+01)	(1.5e+01)		(1.9e+01)		(1.5e+01)	
f_{12}	2.9e+02	2.6e+02	−	1.7e+02	−	3.2e+02	+
	(1.4e+01)	(1.3e+01)		(3.7e+01)		(1.6e+01)	
f_{13}	3.0e+02	2.6e+02	−	1.9e+02	−	3.2e+02	+
	(1.6e+01)	(1.4e+01)		(3.4e+01)		(1.4e+01)	
f_{14}	7.0e+03	5.4e+03	−	2.0e+03	−	7.1e+03	·
	(3.1e+02)	(2.9e+02)		(4.2e+02)		(2.0e+02)	
f_{15}	7.4e+03	7.4e+03	·	5.8e+03	−	7.4e+03	·
	(2.6e+02)	(2.9e+02)		(6.5e+02)		(2.5e+02)	
f_{16}	2.4e+00	2.5e+00	·	2.2e+00	−	2.5e+00	·
	(2.7e−01)	(2.7e−01)		(3.8e−01)		(2.5e−01)	
f_{17}	4.5e+02	3.4e+02	−	2.2e+02	−	6.2e+02	+
	(4.1e+01)	(2.1e+01)		(5.1e+01)		(3.5e+01)	
f_{18}	4.6e+02	3.5e+02	−	3.0e+02	−	6.3e+02	+
	(3.5e+01)	(2.3e+01)		(5.1e+01)		(3.5e+01)	
f_{19}	1.1e+02	3.8e+01	−	3.7e+01	−	3.7e+02	+
	(4.0e+01)	(4.7e+00)		(6.1e+01)		(1.1e+02)	
f_{20}	1.3e+01	1.3e+01	·	1.2e+01	−	1.3e+01	·
	(2.6e−01)	(3.0e−01)		(5.7e−01)		(2.4e−01)	
f_{21}	1.3e+03	1.0e+03	−	7.2e+02	−	1.7e+03	+
	(2.0e+02)	(1.7e+02)		(1.9e+02)		(1.1e+02)	
f_{22}	7.3e+03	5.7e+03	−	2.2e+03	−	7.5e+03	·
	(3.2e+02)	(3.5e+02)		(4.6e+02)		(2.5e+02)	
f_{23}	7.7e+03	7.6e+03	·	6.1e+03	−	7.7e+03	·
	(1.9e+02)	(3.3e+02)		(7.1e+02)		(3.3e+02)	
f_{24}	3.0e+02	3.0e+02	−	2.6e+02	−	3.1e+02	+
	(4.7e+00)	(4.5e+00)		(1.1e+01)		(2.8e+00)	
f_{25}	3.2e+02	3.2e+02	·	2.7e+02	−	3.3e+02	+
	(3.5e+00)	(3.7e+00)		(9.6e+00)		(3.6e+00)	
f_{26}	2.1e+02	2.1e+02	−	2.0e+02	−	2.1e+02	·
	(2.6e+00)	(1.9e+00)		(3.1e−01)		(2.9e+00)	
f_{27}	1.3e+03	1.3e+03	−	9.7e+02	−	1.4e+03	+
	(3.0e+01)	(2.9e+01)		(1.1e+02)		(2.5e+01)	
f_{28}	1.8e+03	1.5e+03	−	1.0e+03	−	2.1e+03	+
	(7.2e+01)	(7.6e+01)		(3.0e+02)		(5.6e+01)	
Summary (+/·/−)		0/8/20		0/1/27		17/11/0	

Table 174: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.1e−04	3.4e+01	+	6.9e+01	+	1.4e+04	+
	(9.0e−05)	(8.0e+00)		(1.5e+02)		(3.2e+03)	
f_2	4.3e+06	5.6e+07	+	1.6e+06	−	1.9e+08	+
	(1.5e+06)	(1.1e+07)		(7.4e+05)		(3.7e+07)	
f_3	1.2e+07	4.3e+09	+	1.3e+08	+	4.6e+10	+
	(1.4e+07)	(7.7e+08)		(2.0e+08)		(1.1e+10)	
f_4	1.9e+04	5.6e+04	+	1.6e+04	−	5.6e+04	+
	(4.0e+03)	(7.0e+03)		(6.1e+03)		(9.7e+03)	
f_5	2.9e−03	1.2e+01	+	4.1e+00	+	1.1e+03	+
	(1.2e−03)	(1.8e+00)		(1.3e+01)		(3.5e+02)	
f_6	2.0e+01	7.4e+01	+	3.9e+01	+	8.8e+02	+
	(1.5e+01)	(1.0e+01)		(3.0e+01)		(2.5e+02)	
f_7	1.4e+01	7.5e+01	+	3.8e+01	+	2.0e+02	+
	(4.8e+00)	(6.6e+00)		(1.5e+01)		(2.9e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.6e−02)	(5.2e−02)		(5.9e−02)		(4.3e−02)	
f_9	3.3e+01	4.0e+01	+	2.1e+01	−	3.9e+01	+
	(7.5e+00)	(8.6e−01)		(3.9e+00)		(1.2e+00)	
f_{10}	1.0e+00	8.4e+01	+	8.2e+00	+	1.8e+03	+
	(8.0e−02)	(2.2e+01)		(2.1e+01)		(3.6e+02)	
f_{11}	4.4e+01	1.8e+02	+	5.9e+01	+	3.9e+02	+
	(2.3e+01)	(1.1e+01)		(1.7e+01)		(3.7e+01)	
f_{12}	1.7e+02	2.2e+02	+	9.9e+01	−	4.1e+02	+
	(3.2e+01)	(1.3e+01)		(2.3e+01)		(4.0e+01)	
f_{13}	2.0e+02	2.2e+02	+	1.4e+02	−	4.1e+02	+
	(1.4e+01)	(1.5e+01)		(3.1e+01)		(3.2e+01)	
f_{14}	7.0e+03	5.3e+03	−	1.6e+03	−	6.9e+03	·
	(2.1e+02)	(3.4e+02)		(3.8e+02)		(2.5e+02)	
f_{15}	7.3e+03	7.3e+03	·	4.9e+03	−	7.4e+03	·
	(3.1e+02)	(2.8e+02)		(9.6e+02)		(3.3e+02)	
f_{16}	2.5e+00	2.4e+00	·	2.2e+00	−	2.5e+00	·
	(2.8e−01)	(2.8e−01)		(4.4e−01)		(2.7e−01)	
f_{17}	2.2e+02	2.4e+02	+	1.5e+02	−	1.0e+03	+
	(1.5e+01)	(1.4e+01)		(3.4e+01)		(1.4e+02)	
f_{18}	2.4e+02	2.6e+02	+	1.7e+02	−	9.9e+02	+
	(1.2e+01)	(1.8e+01)		(3.7e+01)		(1.7e+02)	
f_{19}	1.4e+01	1.9e+01	+	7.7e+00	−	1.3e+04	+
	(2.0e+00)	(1.7e+00)		(2.2e+00)		(9.9e+03)	
f_{20}	1.3e+01	1.3e+01	·	1.2e+01	−	1.4e+01	+
	(2.3e−01)	(2.4e−01)		(5.4e−01)		(3.1e−01)	
f_{21}	2.9e+02	4.8e+02	+	3.7e+02	+	2.2e+03	+
	(8.4e+01)	(9.6e+01)		(1.1e+02)		(2.8e+02)	
f_{22}	7.0e+03	5.7e+03	−	1.7e+03	−	7.4e+03	+
	(3.8e+02)	(3.4e+02)		(4.2e+02)		(3.2e+02)	
f_{23}	7.5e+03	7.4e+03	·	5.0e+03	−	7.8e+03	+
	(2.9e+02)	(2.8e+02)		(1.1e+03)		(3.0e+02)	
f_{24}	2.2e+02	2.7e+02	+	2.5e+02	+	3.1e+02	+
	(9.3e+00)	(5.6e+00)		(9.3e+00)		(4.9e+00)	
f_{25}	2.5e+02	3.2e+02	+	2.6e+02	+	3.3e+02	+
	(7.4e+00)	(4.0e+00)		(8.2e+00)		(5.4e+00)	
f_{26}	2.0e+02	2.0e+02	+	2.0e+02	−	2.2e+02	+
	(8.0e−02)	(8.5e−01)		(4.2e−02)		(5.5e+00)	
f_{27}	5.9e+02	1.3e+03	+	8.0e+02	+	1.3e+03	+
	(1.5e+02)	(4.7e+01)		(8.9e+01)		(3.1e+01)	
f_{28}	3.0e+02	6.3e+02	+	4.6e+02	+	2.9e+03	+
	(2.2e−01)	(3.3e+01)		(2.7e+02)		(3.0e+02)	
Summary (+/·/−)		21/5/2		12/1/15		24/4/0	

Table 175: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	1.1e−06	+	0.0e+00	·
	(0.0e+00)	(0.0e+00)		(7.7e−07)		(0.0e+00)	
f_2	1.5e+07	1.5e+07	·	1.3e+07	·	2.1e+07	+
	(4.3e+06)	(3.9e+06)		(3.9e+06)		(2.9e+06)	
f_3	2.1e+05	2.7e+05	·	1.6e+09	+	6.1e+03	−
	(3.5e+05)	(6.2e+05)		(1.5e+09)		(3.3e+03)	
f_4	6.7e+04	6.6e+04	·	5.3e+04	−	5.2e+04	−
	(7.4e+03)	(8.2e+03)		(8.8e+03)		(3.9e+03)	
f_5	5.8e−08	1.9e−08	·	6.6e−04	+	0.0e+00	·
	(3.6e−07)	(1.2e−07)		(4.6e−04)		(0.0e+00)	
f_6	4.7e+01	4.7e+01	·	4.4e+01	−	4.5e+01	−
	(5.5e−01)	(5.8e−01)		(1.1e+00)		(2.8e−01)	
f_7	2.5e+00	2.6e+00	·	7.7e+01	+	3.5e+00	+
	(2.0e+00)	(2.0e+00)		(2.2e+01)		(7.0e−01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(2.9e−02)	(3.8e−02)		(3.6e−02)		(3.4e−02)	
f_9	6.9e+01	7.0e+01	·	2.6e+01	−	7.2e+01	+
	(3.2e+00)	(1.9e+00)		(4.1e+00)		(1.3e+00)	
f_{10}	3.8e−01	3.2e−01	·	1.1e+00	+	1.3e−03	−
	(3.7e−01)	(3.2e−01)		(1.4e−01)		(5.9e−04)	
f_{11}	2.8e+02	2.8e+02	·	1.4e+02	−	3.2e+02	+
	(1.5e+01)	(1.3e+01)		(3.5e+01)		(1.6e+01)	
f_{12}	3.4e+02	3.4e+02	·	1.3e+02	−	3.6e+02	+
	(1.4e+01)	(1.4e+01)		(5.9e+01)		(1.1e+01)	
f_{13}	3.4e+02	3.4e+02	·	3.9e+02	+	3.5e+02	·
	(1.2e+01)	(1.4e+01)		(5.6e+01)		(1.6e+01)	
f_{14}	1.2e+04	1.2e+04	·	3.4e+03	−	1.3e+04	+
	(5.2e+02)	(4.1e+02)		(6.4e+02)		(3.5e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.3e+04	·	1.4e+04	·
	(3.3e+02)	(4.0e+02)		(1.1e+03)		(3.8e+02)	
f_{16}	3.4e+00	3.4e+00	·	3.3e+00	·	3.3e+00	·
	(2.6e−01)	(2.9e−01)		(2.9e−01)		(2.8e−01)	
f_{17}	3.5e+02	3.4e+02	·	2.4e+02	−	3.8e+02	+
	(1.4e+01)	(1.4e+01)		(3.6e+01)		(1.3e+01)	
f_{18}	3.9e+02	3.9e+02	·	4.7e+02	+	4.0e+02	+
	(1.4e+01)	(1.1e+01)		(2.2e+01)		(1.5e+01)	
f_{19}	2.8e+01	2.8e+01	·	1.1e+01	−	3.0e+01	+
	(1.5e+00)	(1.1e+00)		(2.7e+00)		(1.4e+00)	
f_{20}	2.2e+01	2.2e+01	·	2.2e+01	+	2.2e+01	·
	(2.6e−01)	(2.6e−01)		(3.9e−01)		(2.2e−01)	
f_{21}	3.0e+02	3.8e+02	·	7.8e+02	+	2.8e+02	−
	(2.9e+02)	(3.7e+02)		(3.9e+02)		(2.5e+02)	
f_{22}	1.2e+04	1.2e+04	·	4.1e+03	−	1.3e+04	+
	(3.5e+02)	(4.0e+02)		(5.8e+02)		(2.8e+02)	
f_{23}	1.3e+04	1.4e+04	·	1.3e+04	·	1.3e+04	·
	(3.9e+02)	(3.7e+02)		(1.7e+03)		(3.5e+02)	
f_{24}	2.1e+02	2.1e+02	·	2.8e+02	+	2.0e+02	−
	(1.3e+01)	(9.8e+00)		(1.1e+01)		(1.1e−01)	
f_{25}	2.8e+02	2.8e+02	·	3.1e+02	+	2.8e+02	+
	(6.5e+00)	(6.5e+00)		(1.1e+01)		(8.7e+00)	
f_{26}	2.2e+02	2.2e+02	·	3.5e+02	+	3.2e+02	+
	(5.3e+01)	(4.4e+01)		(5.6e+01)		(1.5e+01)	
f_{27}	6.6e+02	6.5e+02	·	1.0e+03	+	3.4e+02	−
	(1.4e+02)	(1.4e+02)		(9.7e+01)		(8.2e+00)	
f_{28}	4.0e+02	4.0e+02	·	1.4e+03	+	4.0e+02	−
	(6.2e−07)	(6.6e−07)		(1.5e+03)		(5.3e−09)	
Summary (+/·/−)		0/28/0		14/5/9		12/8/8	

Table 176: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	3.1e−03	2.3e−05	−	6.0e−04	−	1.9e−04	−
	(8.5e−04)	(5.9e−06)		(5.2e−04)		(2.7e−05)	
f_2	9.6e+07	5.8e+07	−	1.5e+07	−	8.2e+07	−
	(1.3e+07)	(9.6e+06)		(6.1e+06)		(1.0e+07)	
f_3	1.7e+09	1.7e+08	−	2.0e+09	·	5.5e+09	+
	(4.6e+08)	(6.5e+07)		(1.5e+09)		(8.2e+08)	
f_4	9.3e+04	8.5e+04	·	6.5e+04	−	7.8e+04	−
	(1.2e+04)	(9.7e+03)		(1.1e+04)		(7.7e+03)	
f_5	2.9e−02	1.2e−03	−	2.9e−02	·	5.4e−03	−
	(6.5e−03)	(2.5e−04)		(1.9e−02)		(4.5e−04)	
f_6	4.5e+01	4.5e+01	−	4.6e+01	·	4.3e+01	−
	(2.7e−01)	(4.0e−01)		(1.7e+00)		(1.7e−03)	
f_7	5.2e+01	3.0e+01	−	7.5e+01	+	7.3e+01	+
	(6.0e+00)	(4.6e+00)		(1.8e+01)		(4.2e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.9e−02)	(3.9e−02)		(4.1e−02)		(3.8e−02)	
f_9	7.2e+01	7.2e+01	·	3.1e+01	−	7.2e+01	·
	(1.9e+00)	(1.8e+00)		(6.8e+00)		(1.9e+00)	
f_{10}	1.1e+01	1.6e+00	−	2.1e+00	−	3.4e+01	+
	(3.1e+00)	(2.2e−01)		(6.8e−01)		(3.6e+00)	
f_{11}	3.6e+02	3.2e+02	−	1.5e+02	−	3.7e+02	+
	(1.3e+01)	(1.4e+01)		(3.5e+01)		(1.3e+01)	
f_{12}	3.8e+02	3.7e+02	−	1.3e+02	−	4.0e+02	+
	(1.7e+01)	(1.6e+01)		(5.3e+01)		(1.2e+01)	
f_{13}	3.8e+02	3.7e+02	−	3.7e+02	·	4.0e+02	+
	(1.8e+01)	(1.2e+01)		(6.1e+01)		(1.3e+01)	
f_{14}	1.3e+04	1.2e+04	−	3.7e+03	−	1.3e+04	·
	(3.4e+02)	(4.2e+02)		(7.5e+02)		(3.6e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.3e+04	·	1.4e+04	·
	(3.4e+02)	(4.0e+02)		(9.2e+02)		(3.1e+02)	
f_{16}	3.3e+00	3.4e+00	·	3.3e+00	·	3.3e+00	·
	(2.6e−01)	(2.6e−01)		(3.1e−01)		(3.2e−01)	
f_{17}	4.2e+02	3.8e+02	−	2.4e+02	−	4.4e+02	+
	(1.4e+01)	(1.6e+01)		(3.3e+01)		(1.3e+01)	
f_{18}	4.4e+02	4.2e+02	−	4.7e+02	+	4.5e+02	+
	(1.3e+01)	(1.3e+01)		(2.5e+01)		(1.5e+01)	
f_{19}	3.3e+01	3.1e+01	−	1.3e+01	−	3.4e+01	·
	(1.2e+00)	(1.1e+00)		(3.4e+00)		(1.5e+00)	
f_{20}	2.2e+01	2.2e+01	−	2.3e+01	·	2.2e+01	·
	(2.1e−01)	(2.5e−01)		(3.4e−01)		(2.1e−01)	
f_{21}	2.0e+02	2.4e+02	−	6.8e+02	·	2.0e+02	−
	(1.4e−01)	(1.8e+02)		(4.2e+02)		(1.7e−02)	
f_{22}	1.3e+04	1.2e+04	−	4.1e+03	−	1.3e+04	·
	(2.8e+02)	(4.8e+02)		(8.1e+02)		(3.5e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.3e+02)	(3.9e+02)		(9.7e+02)		(3.5e+02)	
f_{24}	2.8e+02	2.3e+02	−	2.8e+02	·	2.8e+02	·
	(1.9e+01)	(1.2e+01)		(1.2e+01)		(5.2e+00)	
f_{25}	3.4e+02	3.2e+02	·	3.1e+02	−	3.8e+02	+
	(2.6e+01)	(2.1e+01)		(9.3e+00)		(1.8e+01)	
f_{26}	2.7e+02	2.6e+02	−	3.5e+02	·	4.4e+02	+
	(1.1e+02)	(1.1e+02)		(6.2e+01)		(4.1e+01)	
f_{27}	1.8e+03	1.4e+03	−	1.1e+03	−	1.7e+03	·
	(1.4e+02)	(2.9e+02)		(1.2e+02)		(7.3e+01)	
f_{28}	4.0e+02	4.0e+02	−	1.0e+03	−	4.0e+02	−
	(5.7e−02)	(6.8e−03)		(1.2e+03)		(7.8e−03)	
Summary (+/·/−)		0/7/21		2/12/14		10/11/7	

Table 177: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	4.6e+04	6.0e+04	+	4.8e+04	·	5.3e+04	+
	(7.5e+03)	(4.4e+03)		(7.1e+03)		(7.0e+03)	
f_2	4.1e+08	9.8e+08	+	4.0e+08	·	4.1e+08	·
	(1.5e+08)	(1.3e+08)		(1.1e+08)		(1.4e+08)	
f_3	2.3e+11	5.1e+11	+	2.9e+11	·	2.5e+11	·
	(1.8e+11)	(2.8e+11)		(6.3e+11)		(1.9e+11)	
f_4	3.0e+00	1.4e+05	+	4.3e+00	·	2.0e+00	·
	(2.9e+00)	(9.3e+03)		(6.5e+00)		(1.4e+00)	
f_5	9.1e+03	1.4e+04	+	8.1e+03	·	9.8e+03	·
	(3.0e+03)	(1.8e+03)		(2.4e+03)		(3.3e+03)	
f_6	3.3e+03	5.4e+03	+	3.3e+03	·	3.6e+03	·
	(7.5e+02)	(7.0e+02)		(7.8e+02)		(7.8e+02)	
f_7	2.8e+02	4.4e+02	+	3.5e+02	·	4.0e+02	·
	(1.9e+02)	(1.2e+02)		(3.9e+02)		(4.3e+02)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.7e−02)	(3.1e−02)		(4.0e−02)		(4.7e−02)	
f_9	5.6e+01	7.3e+01	+	5.6e+01	·	5.0e+01	−
	(4.0e+00)	(1.6e+00)		(3.8e+00)		(3.6e+00)	
f_{10}	5.3e+03	8.2e+03	+	5.3e+03	·	5.4e+03	·
	(1.2e+03)	(7.4e+02)		(1.1e+03)		(9.1e+02)	
f_{11}	8.4e+02	1.1e+03	+	8.4e+02	·	8.7e+02	·
	(1.2e+02)	(6.0e+01)		(1.1e+02)		(1.2e+02)	
f_{12}	8.1e+02	1.1e+03	+	8.1e+02	·	8.0e+02	·
	(1.1e+02)	(5.9e+01)		(1.2e+02)		(1.1e+02)	
f_{13}	9.1e+02	1.1e+03	+	8.9e+02	·	9.3e+02	·
	(1.1e+02)	(6.2e+01)		(1.1e+02)		(1.2e+02)	
f_{14}	8.3e+03	1.2e+04	+	8.2e+03	·	8.0e+03	·
	(6.7e+02)	(3.5e+02)		(6.7e+02)		(7.1e+02)	
f_{15}	8.7e+03	1.4e+04	+	8.6e+03	·	7.3e+03	−
	(9.7e+02)	(3.6e+02)		(7.4e+02)		(7.5e+02)	
f_{16}	2.0e+00	3.4e+00	+	1.9e+00	·	3.3e+00	+
	(9.8e−01)	(2.6e−01)		(9.9e−01)		(3.0e−01)	
f_{17}	1.5e+03	2.5e+03	+	1.6e+03	·	1.7e+03	+
	(2.1e+02)	(1.7e+02)		(2.3e+02)		(1.9e+02)	
f_{18}	1.6e+03	2.5e+03	+	1.6e+03	·	1.7e+03	·
	(2.0e+02)	(1.7e+02)		(2.0e+02)		(1.5e+02)	
f_{19}	2.3e+05	6.0e+05	+	2.7e+05	·	3.5e+05	+
	(1.2e+05)	(1.6e+05)		(1.8e+05)		(2.1e+05)	
f_{20}	2.3e+01	2.5e+01	+	2.3e+01	·	2.2e+01	−
	(1.2e+00)	(2.2e−01)		(1.4e+00)		(1.2e+00)	
f_{21}	4.7e+03	6.5e+03	+	4.5e+03	·	4.7e+03	·
	(3.6e+02)	(3.9e+02)		(3.9e+02)		(3.4e+02)	
f_{22}	9.6e+03	1.4e+04	+	9.8e+03	·	9.6e+03	·
	(1.2e+03)	(4.0e+02)		(1.1e+03)		(1.0e+03)	
f_{23}	1.1e+04	1.5e+04	+	1.0e+04	·	8.8e+03	−
	(1.3e+03)	(3.3e+02)		(1.2e+03)		(1.1e+03)	
f_{24}	4.1e+02	4.3e+02	+	4.1e+02	·	4.1e+02	·
	(1.5e+01)	(5.9e+00)		(1.4e+01)		(1.5e+01)	
f_{25}	4.5e+02	4.8e+02	+	4.6e+02	·	4.5e+02	·
	(1.5e+01)	(8.8e+00)		(1.0e+01)		(1.6e+01)	
f_{26}	4.5e+02	3.7e+02	−	4.4e+02	·	4.4e+02	−
	(4.7e+01)	(2.9e+01)		(4.6e+01)		(4.4e+01)	
f_{27}	2.0e+03	2.4e+03	+	2.0e+03	·	1.9e+03	·
	(1.0e+02)	(4.5e+01)		(8.4e+01)		(1.0e+02)	
f_{28}	6.5e+03	7.7e+03	+	6.5e+03	·	6.4e+03	·
	(5.8e+02)	(4.1e+02)		(6.6e+02)		(4.8e+02)	
Summary (+/·/−)		26/1/1		0/28/0		4/19/5	

Table 178: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	2.2e+04	5.3e+04	+	2.1e+04	·	2.4e+04	·
	(3.8e+03)	(3.6e+03)		(4.3e+03)		(3.9e+03)	
f_2	1.9e+08	9.0e+08	+	1.9e+08	·	1.8e+08	·
	(6.7e+07)	(1.3e+08)		(6.8e+07)		(6.6e+07)	
f_3	3.3e+10	2.7e+11	+	2.6e+10	·	1.9e+10	·
	(4.3e+10)	(1.1e+11)		(3.2e+10)		(2.8e+10)	
f_4	2.9e+01	1.3e+05	+	2.5e+01	·	5.1e+01	+
	(1.4e+01)	(1.1e+04)		(1.3e+01)		(2.0e+01)	
f_5	3.4e+03	1.2e+04	+	3.4e+03	·	3.5e+03	·
	(9.8e+02)	(1.8e+03)		(1.1e+03)		(1.1e+03)	
f_6	1.2e+03	4.5e+03	+	1.2e+03	·	1.2e+03	·
	(2.7e+02)	(6.2e+02)		(3.2e+02)		(3.8e+02)	
f_7	1.4e+02	3.3e+02	+	1.5e+02	·	1.3e+02	·
	(3.5e+01)	(4.5e+01)		(2.6e+01)		(3.6e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.0e−02)	(3.8e−02)		(3.7e−02)		(3.7e−02)	
f_9	4.6e+01	7.2e+01	+	4.9e+01	·	4.3e+01	−
	(4.0e+00)	(1.4e+00)		(4.5e+00)		(3.2e+00)	
f_{10}	2.9e+03	7.5e+03	+	3.0e+03	·	3.0e+03	·
	(7.0e+02)	(6.7e+02)		(7.8e+02)		(6.6e+02)	
f_{11}	5.4e+02	1.0e+03	+	5.4e+02	·	5.0e+02	·
	(7.7e+01)	(4.6e+01)		(8.3e+01)		(8.1e+01)	
f_{12}	5.3e+02	1.1e+03	+	5.7e+02	·	5.1e+02	·
	(7.4e+01)	(5.8e+01)		(9.4e+01)		(7.3e+01)	
f_{13}	6.7e+02	1.1e+03	+	6.7e+02	·	6.6e+02	·
	(7.8e+01)	(4.6e+01)		(8.5e+01)		(9.3e+01)	
f_{14}	6.5e+03	1.2e+04	+	6.6e+03	·	5.9e+03	·
	(8.1e+02)	(4.0e+02)		(7.7e+02)		(7.2e+02)	
f_{15}	7.1e+03	1.4e+04	+	7.4e+03	·	9.7e+03	·
	(1.4e+03)	(3.3e+02)		(9.3e+02)		(3.6e+03)	
f_{16}	3.3e+00	3.4e+00	·	3.2e+00	·	3.3e+00	·
	(2.9e−01)	(3.0e−01)		(3.4e−01)		(3.5e−01)	
f_{17}	9.1e+02	2.4e+03	+	9.7e+02	·	9.2e+02	·
	(1.4e+02)	(1.3e+02)		(1.5e+02)		(1.3e+02)	
f_{18}	9.5e+02	2.4e+03	+	9.7e+02	·	9.4e+02	·
	(1.4e+02)	(1.3e+02)		(1.4e+02)		(1.5e+02)	
f_{19}	3.0e+04	3.9e+05	+	3.4e+04	·	2.4e+04	·
	(2.3e+04)	(1.3e+05)		(2.4e+04)		(1.4e+04)	
f_{20}	2.2e+01	2.4e+01	+	2.2e+01	·	2.2e+01	·
	(1.0e+00)	(2.3e−01)		(1.2e+00)		(1.0e+00)	
f_{21}	3.5e+03	6.2e+03	+	3.5e+03	·	3.6e+03	·
	(4.6e+02)	(4.0e+02)		(4.6e+02)		(4.2e+02)	
f_{22}	8.1e+03	1.3e+04	+	8.3e+03	·	7.5e+03	·
	(1.3e+03)	(3.9e+02)		(1.2e+03)		(9.8e+02)	
f_{23}	8.3e+03	1.5e+04	+	8.9e+03	·	8.4e+03	·
	(1.1e+03)	(3.1e+02)		(1.2e+03)		(2.2e+03)	
f_{24}	3.7e+02	4.2e+02	+	3.7e+02	·	3.6e+02	·
	(1.2e+01)	(6.9e+00)		(1.2e+01)		(1.2e+01)	
f_{25}	4.1e+02	4.7e+02	+	4.1e+02	·	4.1e+02	·
	(1.5e+01)	(6.5e+00)		(1.2e+01)		(1.3e+01)	
f_{26}	4.1e+02	3.8e+02	−	4.2e+02	·	4.1e+02	·
	(5.1e+01)	(3.0e+01)		(5.3e+01)		(4.9e+01)	
f_{27}	1.7e+03	2.3e+03	+	1.7e+03	·	1.6e+03	·
	(9.7e+01)	(4.8e+01)		(1.1e+02)		(1.1e+02)	
f_{28}	4.6e+03	7.1e+03	+	4.3e+03	·	4.4e+03	·
	(8.7e+02)	(4.6e+02)		(9.6e+02)		(9.0e+02)	
Summary (+/·/−)		25/2/1		0/28/0		1/26/1	

Table 179: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	4.8e+04	2.3e+04	−	1.8e−01	−	2.4e+04	−
	(2.1e+03)	(2.4e+03)		(1.3e+00)		(1.5e+03)	
f_2	5.0e+08	4.8e+08	·	1.6e+06	−	7.9e+07	−
	(8.7e+07)	(6.6e+07)		(5.9e+05)		(9.2e+06)	
f_3	1.7e+11	9.9e+10	−	2.7e+08	−	4.6e+10	−
	(5.4e+10)	(8.7e+09)		(3.5e+08)		(4.2e+09)	
f_4	5.9e+04	1.1e+05	+	9.2e+03	−	3.7e+04	−
	(3.1e+03)	(9.0e+03)		(2.4e+03)		(3.0e+03)	
f_5	6.7e+03	4.0e+03	−	1.7e+01	−	2.8e+03	−
	(8.5e+02)	(5.3e+02)		(2.5e+01)		(3.7e+02)	
f_6	3.7e+03	1.4e+03	−	7.2e+01	−	1.0e+03	−
	(3.5e+02)	(1.4e+02)		(3.3e+01)		(9.8e+01)	
f_7	1.8e+02	2.0e+02	·	8.3e+01	−	6.5e+01	−
	(3.7e+01)	(1.2e+01)		(2.4e+01)		(6.9e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.4e−02)	(3.8e−02)		(3.0e−02)		(3.3e−02)	
f_9	3.5e+01	7.1e+01	+	3.0e+01	−	3.3e+01	−
	(1.6e+00)	(1.7e+00)		(3.8e+00)		(1.7e+00)	
f_{10}	5.7e+03	3.9e+03	−	1.3e+01	−	2.1e+03	−
	(3.9e+02)	(3.7e+02)		(1.4e+01)		(1.9e+02)	
f_{11}	4.8e+02	6.6e+02	+	2.0e+02	−	2.4e+02	−
	(2.6e+01)	(3.6e+01)		(4.2e+01)		(1.9e+01)	
f_{12}	5.6e+02	7.2e+02	+	2.0e+02	−	2.7e+02	−
	(3.2e+01)	(4.0e+01)		(5.7e+01)		(2.0e+01)	
f_{13}	7.5e+02	7.2e+02	−	3.3e+02	−	4.1e+02	−
	(3.0e+01)	(3.7e+01)		(6.9e+01)		(2.8e+01)	
f_{14}	1.3e+04	1.2e+04	−	4.1e+03	−	1.2e+04	−
	(3.3e+02)	(3.7e+02)		(6.6e+02)		(3.9e+02)	
f_{15}	1.4e+04	1.4e+04	·	9.7e+03	−	1.3e+04	−
	(3.7e+02)	(2.8e+02)		(3.1e+03)		(3.3e+02)	
f_{16}	3.3e+00	3.4e+00	·	3.3e+00	·	3.3e+00	·
	(2.8e−01)	(2.8e−01)		(3.0e−01)		(2.6e−01)	
f_{17}	8.8e+02	1.4e+03	+	2.7e+02	−	4.5e+02	−
	(3.9e+01)	(7.5e+01)		(6.5e+01)		(5.9e+01)	
f_{18}	9.1e+02	1.4e+03	+	4.8e+02	−	5.1e+02	−
	(4.1e+01)	(8.7e+01)		(5.3e+01)		(2.6e+01)	
f_{19}	1.8e+05	2.3e+04	−	1.7e+01	−	3.3e+04	−
	(3.7e+04)	(8.4e+03)		(5.8e+00)		(8.1e+03)	
f_{20}	2.2e+01	2.3e+01	+	2.2e+01	·	2.1e+01	−
	(2.4e−01)	(2.5e−01)		(5.0e−01)		(2.9e−01)	
f_{21}	4.0e+03	3.1e+03	−	8.1e+02	−	3.6e+03	−
	(5.0e+01)	(2.0e+02)		(3.8e+02)		(4.4e+01)	
f_{22}	1.3e+04	1.2e+04	−	5.3e+03	−	6.0e+03	−
	(3.7e+02)	(4.3e+02)		(8.4e+02)		(3.8e+03)	
f_{23}	1.5e+04	1.4e+04	−	8.9e+03	−	1.1e+04	−
	(5.6e+02)	(3.6e+02)		(2.0e+03)		(1.1e+03)	
f_{24}	4.7e+02	3.9e+02	−	3.0e+02	−	3.5e+02	−
	(1.7e+01)	(4.3e+00)		(1.2e+01)		(8.9e+00)	
f_{25}	4.8e+02	4.3e+02	−	3.3e+02	−	4.3e+02	−
	(1.4e+01)	(5.8e+00)		(1.0e+01)		(7.8e+00)	
f_{26}	2.1e+02	2.8e+02	+	3.7e+02	+	3.6e+02	+
	(4.0e+00)	(6.9e+01)		(5.0e+01)		(1.7e+01)	
f_{27}	1.9e+03	2.2e+03	+	1.2e+03	−	1.4e+03	−
	(7.5e+01)	(3.5e+01)		(1.2e+02)		(4.9e+01)	
f_{28}	5.4e+03	3.3e+03	−	1.2e+03	−	4.2e+03	−
	(4.0e+02)	(2.6e+02)		(1.4e+03)		(2.5e+02)	
Summary (+/·/−)		9/5/14		1/3/24		1/2/25	

Table 180: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.7e+04	3.3e+04	+	1.4e+02	−	1.4e+03	−
	(2.8e+03)	(2.8e+03)		(1.2e+02)		(6.1e+02)	
f_2	1.2e+08	6.1e+08	+	1.1e+06	−	5.5e+05	−
	(3.8e+07)	(7.6e+07)		(4.0e+05)		(1.8e+05)	
f_3	5.3e+10	1.3e+11	+	1.3e+08	−	1.9e+08	−
	(1.6e+10)	(1.1e+10)		(1.4e+08)		(3.6e+08)	
f_4	7.5e+03	1.2e+05	+	3.3e+03	−	6.2e+02	−
	(2.2e+03)	(1.0e+04)		(9.6e+02)		(1.9e+02)	
f_5	2.1e+03	6.1e+03	+	2.9e+02	−	6.3e+02	−
	(5.7e+02)	(8.3e+02)		(1.2e+02)		(2.5e+02)	
f_6	8.8e+02	2.2e+03	+	1.4e+02	−	2.2e+02	−
	(1.7e+02)	(3.0e+02)		(6.7e+01)		(6.8e+01)	
f_7	8.1e+01	2.3e+02	+	9.4e+01	·	6.5e+01	−
	(1.6e+01)	(1.2e+01)		(2.3e+01)		(1.8e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.4e−02)	(3.5e−02)		(4.0e−02)		(3.2e−02)	
f_9	3.5e+01	7.2e+01	+	3.3e+01	·	2.7e+01	−
	(2.9e+00)	(1.7e+00)		(4.0e+00)		(3.0e+00)	
f_{10}	2.0e+03	5.2e+03	+	3.5e+02	−	4.9e+02	−
	(4.3e+02)	(5.0e+02)		(2.1e+02)		(1.7e+02)	
f_{11}	2.8e+02	7.9e+02	+	2.5e+02	·	1.5e+02	−
	(5.4e+01)	(3.9e+01)		(5.4e+01)		(3.0e+01)	
f_{12}	2.7e+02	8.4e+02	+	2.4e+02	−	1.7e+02	−
	(4.3e+01)	(3.2e+01)		(6.3e+01)		(7.4e+01)	
f_{13}	4.3e+02	8.4e+02	+	4.0e+02	·	4.0e+02	·
	(4.2e+01)	(4.0e+01)		(6.9e+01)		(6.8e+01)	
f_{14}	1.3e+04	1.2e+04	−	4.4e+03	−	1.3e+04	·
	(4.4e+02)	(4.0e+02)		(7.3e+02)		(5.0e+02)	
f_{15}	1.4e+04	1.4e+04	+	7.9e+03	−	1.4e+04	·
	(3.9e+02)	(2.5e+02)		(1.9e+03)		(4.0e+02)	
f_{16}	3.4e+00	3.4e+00	·	3.3e+00	·	3.4e+00	·
	(2.9e−01)	(2.5e−01)		(2.8e−01)		(2.5e−01)	
f_{17}	5.7e+02	1.8e+03	+	3.3e+02	−	4.5e+02	−
	(6.3e+01)	(1.1e+02)		(6.6e+01)		(3.7e+01)	
f_{18}	6.1e+02	1.8e+03	+	4.3e+02	−	4.9e+02	−
	(5.4e+01)	(1.1e+02)		(1.0e+02)		(3.3e+01)	
f_{19}	7.4e+03	6.4e+04	+	4.3e+01	−	1.1e+02	−
	(4.9e+03)	(2.0e+04)		(2.6e+01)		(2.1e+02)	
f_{20}	2.1e+01	2.4e+01	+	2.2e+01	+	2.1e+01	·
	(4.0e−01)	(2.5e−01)		(7.4e−01)		(5.1e−01)	
f_{21}	3.4e+03	4.0e+03	+	8.6e+02	−	1.6e+03	−
	(2.1e+02)	(3.2e+02)		(3.4e+02)		(4.8e+02)	
f_{22}	1.2e+04	1.3e+04	·	5.8e+03	−	1.2e+04	·
	(1.2e+03)	(4.5e+02)		(1.2e+03)		(2.8e+03)	
f_{23}	1.4e+04	1.4e+04	+	8.1e+03	−	1.4e+04	·
	(7.1e+02)	(3.4e+02)		(1.5e+03)		(4.6e+02)	
f_{24}	3.7e+02	4.0e+02	+	3.1e+02	−	3.0e+02	−
	(1.5e+01)	(4.8e+00)		(1.2e+01)		(1.1e+01)	
f_{25}	4.4e+02	4.5e+02	·	3.5e+02	−	3.5e+02	−
	(1.6e+01)	(5.5e+00)		(1.0e+01)		(1.2e+01)	
f_{26}	3.5e+02	3.0e+02	·	3.8e+02	·	3.6e+02	−
	(9.2e+01)	(5.8e+01)		(4.6e+01)		(4.9e+01)	
f_{27}	1.6e+03	2.2e+03	+	1.3e+03	−	1.1e+03	−
	(8.3e+01)	(3.6e+01)		(1.0e+02)		(7.7e+01)	
f_{28}	4.1e+03	4.5e+03	·	1.1e+03	−	1.9e+03	−
	(6.2e+02)	(3.6e+02)		(1.3e+03)		(1.2e+03)	
Summary (+/·/−)		21/6/1		1/7/20		0/8/20	

Table 181: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	2.7e−02	·	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.4e−01)		(0.0e+00)		(0.0e+00)	
f_2	3.3e+06	8.7e+06	+	9.5e+06	+	4.8e+06	+
	(1.2e+06)	(3.3e+06)		(3.3e+06)		(5.6e+05)	
f_3	2.4e+07	9.2e+08	+	1.1e+09	+	2.2e+04	−
	(4.8e+07)	(9.3e+08)		(1.3e+09)		(4.1e+04)	
f_4	3.0e+04	4.3e+04	+	4.2e+04	+	2.9e+04	·
	(3.5e+03)	(6.6e+03)		(6.3e+03)		(3.0e+03)	
f_5	3.3e+00	2.6e+01	·	3.5e−06	−	1.5e−01	−
	(4.0e+00)	(3.1e+01)		(4.0e−06)		(5.1e−01)	
f_6	4.7e+01	4.8e+01	+	4.5e+01	−	4.7e+01	·
	(7.5e−01)	(1.8e+00)		(6.9e+00)		(5.1e−01)	
f_7	4.0e+00	1.9e+01	+	7.5e+01	+	3.4e−02	−
	(1.8e+00)	(5.6e+00)		(2.6e+01)		(3.8e−02)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.7e−02)	(3.6e−02)		(4.4e−02)		(3.8e−02)	
f_9	5.2e+01	1.9e+01	−	2.6e+01	−	7.0e+01	+
	(2.3e+01)	(3.8e+00)		(4.4e+00)		(1.8e+00)	
f_{10}	1.1e+01	4.2e+01	+	6.0e−02	−	1.6e−01	−
	(4.2e+00)	(1.9e+01)		(8.1e−02)		(2.7e−01)	
f_{11}	2.8e+02	1.3e+02	−	1.5e+02	−	3.0e+02	+
	(1.3e+01)	(3.6e+01)		(3.3e+01)		(1.0e+01)	
f_{12}	3.2e+02	2.2e+02	−	1.4e+02	−	3.3e+02	+
	(1.2e+01)	(1.0e+02)		(3.9e+01)		(1.4e+01)	
f_{13}	3.2e+02	2.7e+02	−	3.8e+02	+	3.3e+02	·
	(1.1e+01)	(6.2e+01)		(6.1e+01)		(1.5e+01)	
f_{14}	1.3e+04	1.1e+04	−	3.5e+03	−	1.3e+04	·
	(3.7e+02)	(4.0e+02)		(6.1e+02)		(4.0e+02)	
f_{15}	1.4e+04	1.3e+04	·	1.3e+04	·	1.4e+04	·
	(3.6e+02)	(3.4e+02)		(1.1e+03)		(3.0e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.3e+00	·	3.4e+00	·
	(3.1e−01)	(2.1e−01)		(3.1e−01)		(2.6e−01)	
f_{17}	3.5e+02	3.1e+02	−	2.2e+02	−	3.5e+02	·
	(1.1e+01)	(1.7e+01)		(4.6e+01)		(1.1e+01)	
f_{18}	3.6e+02	3.7e+02	·	4.6e+02	+	3.7e+02	+
	(1.5e+01)	(1.3e+01)		(3.0e+01)		(1.2e+01)	
f_{19}	2.4e+01	1.6e+01	−	1.0e+01	−	2.7e+01	+
	(2.2e+00)	(3.3e+00)		(3.1e+00)		(1.4e+00)	
f_{20}	2.1e+01	2.1e+01	·	2.2e+01	+	2.2e+01	+
	(2.9e−01)	(3.1e−01)		(3.7e−01)		(2.8e−01)	
f_{21}	6.6e+02	6.8e+02	·	8.4e+02	·	5.6e+02	·
	(4.3e+02)	(4.4e+02)		(3.8e+02)		(4.1e+02)	
f_{22}	1.2e+04	9.9e+03	−	4.5e+03	−	1.3e+04	+
	(3.6e+02)	(6.6e+02)		(8.5e+02)		(3.5e+02)	
f_{23}	1.3e+04	1.3e+04	·	1.3e+04	·	1.3e+04	·
	(4.0e+02)	(4.3e+02)		(2.3e+03)		(3.7e+02)	
f_{24}	2.1e+02	2.5e+02	+	2.8e+02	+	2.0e+02	−
	(5.2e+00)	(1.0e+01)		(1.1e+01)		(8.2e−02)	
f_{25}	2.8e+02	2.9e+02	+	3.1e+02	+	2.7e+02	−
	(5.9e+00)	(6.1e+00)		(9.1e+00)		(5.9e+00)	
f_{26}	2.1e+02	2.3e+02	+	3.4e+02	+	3.0e+02	+
	(3.2e+01)	(6.1e+01)		(6.1e+01)		(4.7e+00)	
f_{27}	4.3e+02	8.1e+02	+	9.9e+02	+	3.0e+02	−
	(1.0e+02)	(6.6e+01)		(1.1e+02)		(7.0e+00)	
f_{28}	4.0e+02	4.1e+02	+	1.2e+03	+	4.0e+02	·
	(7.2e−01)	(2.4e+01)		(1.4e+03)		(3.0e−13)	
Summary (+/·/−)		11/9/8		12/6/10		9/12/7	

Table 182: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.3}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	3.2e+04	9.4e+03	−	0.0e+00	−	0.0e+00	−
	(3.9e+03)	(1.6e+03)		(0.0e+00)		(0.0e+00)	
f_2	2.1e+08	2.9e+08	+	3.0e+06	−	3.2e+06	−
	(6.5e+07)	(4.8e+07)		(8.8e+05)		(1.0e+06)	
f_3	1.0e+11	4.8e+10	−	2.0e+08	−	6.8e+07	−
	(6.5e+10)	(6.7e+09)		(2.2e+08)		(7.6e+07)	
f_4	2.1e+04	9.5e+04	+	1.9e+04	·	1.8e+04	·
	(4.4e+03)	(9.2e+03)		(4.1e+03)		(3.0e+03)	
f_5	4.0e+03	1.6e+03	−	0.0e+00	−	0.0e+00	−
	(1.1e+03)	(2.9e+02)		(0.0e+00)		(0.0e+00)	
f_6	1.9e+03	5.5e+02	−	4.6e+01	−	4.6e+01	−
	(3.6e+02)	(7.3e+01)		(1.1e+01)		(1.6e+00)	
f_7	1.0e+02	1.4e+02	+	8.1e+01	−	6.8e+01	−
	(2.2e+01)	(9.6e+00)		(3.2e+01)		(2.4e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.6e−02)	(4.3e−02)		(3.2e−02)		(3.7e−02)	
f_9	3.4e+01	6.7e+01	+	2.8e+01	−	2.0e+01	−
	(2.0e+00)	(2.0e+00)		(3.8e+00)		(7.2e+00)	
f_{10}	3.4e+03	2.0e+03	−	3.2e−02	−	2.5e−02	−
	(5.5e+02)	(3.0e+02)		(2.3e−02)		(1.3e−02)	
f_{11}	3.5e+02	4.7e+02	+	1.8e+02	−	3.8e+02	+
	(4.9e+01)	(2.5e+01)		(5.4e+01)		(2.6e+01)	
f_{12}	3.8e+02	5.3e+02	+	1.8e+02	−	4.0e+02	·
	(5.4e+01)	(2.5e+01)		(5.2e+01)		(2.7e+01)	
f_{13}	5.0e+02	5.4e+02	+	3.6e+02	−	4.0e+02	−
	(6.2e+01)	(2.6e+01)		(8.5e+01)		(2.5e+01)	
f_{14}	1.3e+04	1.2e+04	−	3.9e+03	−	1.3e+04	+
	(3.9e+02)	(3.9e+02)		(6.1e+02)		(4.5e+02)	
f_{15}	1.3e+04	1.4e+04	·	1.1e+04	−	1.4e+04	+
	(4.1e+02)	(3.1e+02)		(2.7e+03)		(4.7e+02)	
f_{16}	3.3e+00	3.4e+00	·	3.3e+00	·	3.3e+00	·
	(3.4e−01)	(2.8e−01)		(2.8e−01)		(2.9e−01)	
f_{17}	6.5e+02	8.1e+02	+	2.3e+02	−	4.3e+02	−
	(8.9e+01)	(6.3e+01)		(4.6e+01)		(2.5e+01)	
f_{18}	7.3e+02	8.1e+02	+	4.7e+02	−	4.4e+02	−
	(6.4e+01)	(6.7e+01)		(3.2e+01)		(2.3e+01)	
f_{19}	4.8e+04	1.7e+03	−	1.2e+01	−	3.2e+01	−
	(3.0e+04)	(6.8e+02)		(2.9e+00)		(2.6e+00)	
f_{20}	2.1e+01	2.3e+01	+	2.2e+01	+	2.2e+01	+
	(4.4e−01)	(1.9e−01)		(4.1e−01)		(3.7e−01)	
f_{21}	3.9e+03	2.0e+03	−	7.7e+02	−	7.9e+02	−
	(1.5e+02)	(2.7e+02)		(4.0e+02)		(4.1e+02)	
f_{22}	1.2e+04	1.2e+04	·	5.1e+03	−	1.3e+04	+
	(1.1e+03)	(4.4e+02)		(7.7e+02)		(4.3e+02)	
f_{23}	1.3e+04	1.4e+04	+	9.7e+03	−	1.4e+04	+
	(7.9e+02)	(4.1e+02)		(2.8e+03)		(4.1e+02)	
f_{24}	4.2e+02	3.7e+02	−	2.9e+02	−	2.7e+02	−
	(1.9e+01)	(5.3e+00)		(1.1e+01)		(1.2e+01)	
f_{25}	4.7e+02	4.1e+02	−	3.2e+02	−	3.0e+02	−
	(1.5e+01)	(5.9e+00)		(1.0e+01)		(1.1e+01)	
f_{26}	3.4e+02	2.6e+02	·	3.6e+02	·	3.4e+02	·
	(8.7e+01)	(8.7e+01)		(5.3e+01)		(4.6e+01)	
f_{27}	1.7e+03	2.0e+03	+	1.1e+03	−	8.7e+02	−
	(8.9e+01)	(5.9e+01)		(1.1e+02)		(8.6e+01)	
f_{28}	5.3e+03	1.8e+03	−	7.1e+02	−	9.3e+02	−
	(3.5e+02)	(1.7e+02)		(9.5e+02)		(1.2e+03)	
Summary (+/·/−)		12/5/11		1/4/23		6/5/17	

Table 183: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	5.0e−05	5.0e−05	·	6.0e−02	+	5.5e−05	+
	(5.8e−06)	(6.2e−06)		(7.9e−03)		(5.4e−06)	
f_2	1.7e+08	1.7e+08	·	1.5e+08	−	1.5e+08	−
	(2.5e+07)	(2.2e+07)		(2.3e+07)		(1.9e+07)	
f_3	3.8e+10	3.8e+10	·	3.8e+10	·	3.5e+10	−
	(4.2e+09)	(3.9e+09)		(4.4e+09)		(3.3e+09)	
f_4	1.3e+05	1.3e+05	·	1.1e+05	−	1.2e+05	·
	(9.0e+03)	(8.8e+03)		(1.1e+04)		(9.0e+03)	
f_5	2.1e−03	2.1e−03	·	2.3e−01	+	1.5e−03	−
	(1.7e−04)	(1.6e−04)		(2.5e−02)		(1.4e−04)	
f_6	4.8e+01	4.8e+01	·	4.9e+01	+	5.2e+01	+
	(9.8e−02)	(1.3e−01)		(9.7e−01)		(1.5e+00)	
f_7	1.5e+02	1.5e+02	·	1.4e+02	−	1.4e+02	−
	(7.4e+00)	(7.5e+00)		(9.1e+00)		(7.5e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.1e−02)	(3.8e−02)		(4.0e−02)		(3.4e−02)	
f_9	6.4e+01	6.4e+01	·	6.3e+01	·	6.4e+01	·
	(1.2e+00)	(1.7e+00)		(1.7e+00)		(1.5e+00)	
f_{10}	6.4e+02	6.5e+02	·	7.6e+02	+	5.8e+02	−
	(6.6e+01)	(7.0e+01)		(7.8e+01)		(5.3e+01)	
f_{11}	7.8e+01	7.8e+01	·	7.5e+01	·	1.0e+02	+
	(4.7e+00)	(4.8e+00)		(5.3e+00)		(5.9e+00)	
f_{12}	4.7e+02	4.6e+02	·	4.9e+02	+	4.6e+02	·
	(1.5e+01)	(1.5e+01)		(2.1e+01)		(1.6e+01)	
f_{13}	4.7e+02	4.7e+02	·	4.9e+02	+	4.6e+02	·
	(1.7e+01)	(1.8e+01)		(2.1e+01)		(1.8e+01)	
f_{14}	3.3e+03	3.3e+03	·	3.3e+03	·	4.5e+03	+
	(1.9e+02)	(2.5e+02)		(2.1e+02)		(1.8e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.7e+02)	(3.4e+02)		(4.3e+02)		(3.1e+02)	
f_{16}	3.3e+00	3.2e+00	·	3.3e+00	·	3.3e+00	·
	(3.7e−01)	(2.6e−01)		(2.5e−01)		(2.8e−01)	
f_{17}	1.4e+02	1.3e+02	·	1.9e+02	+	1.6e+02	+
	(5.2e+00)	(5.1e+00)		(6.6e+00)		(5.6e+00)	
f_{18}	5.0e+02	5.1e+02	·	5.6e+02	+	5.0e+02	·
	(1.6e+01)	(1.5e+01)		(1.9e+01)		(1.4e+01)	
f_{19}	1.7e+01	1.7e+01	·	2.1e+01	+	1.6e+01	−
	(8.1e−01)	(8.8e−01)		(1.2e+00)		(7.7e−01)	
f_{20}	2.4e+01	2.4e+01	·	2.3e+01	−	2.4e+01	·
	(2.6e−01)	(3.0e−01)		(2.8e−01)		(3.3e−01)	
f_{21}	7.3e+02	7.2e+02	·	4.8e+02	−	1.2e+03	+
	(1.1e+02)	(6.8e+01)		(3.7e+02)		(1.4e+02)	
f_{22}	4.9e+03	4.9e+03	·	4.2e+03	−	5.3e+03	+
	(2.9e+02)	(2.2e+02)		(3.3e+02)		(2.6e+02)	
f_{23}	1.4e+04	1.5e+04	·	1.4e+04	−	1.5e+04	·
	(4.1e+02)	(4.0e+02)		(4.7e+02)		(3.7e+02)	
f_{24}	3.6e+02	3.6e+02	·	3.6e+02	·	3.6e+02	·
	(4.1e+00)	(4.2e+00)		(5.6e+00)		(5.1e+00)	
f_{25}	3.9e+02	3.9e+02	·	3.9e+02	·	4.0e+02	+
	(4.4e+00)	(4.5e+00)		(5.0e+00)		(4.4e+00)	
f_{26}	2.2e+02	2.2e+02	·	2.1e+02	−	2.2e+02	·
	(2.5e+00)	(2.6e+00)		(2.4e+00)		(2.6e+00)	
f_{27}	1.9e+03	1.9e+03	·	1.9e+03	·	1.9e+03	·
	(3.2e+01)	(3.5e+01)		(4.9e+01)		(4.3e+01)	
f_{28}	4.1e+02	4.1e+02	·	4.0e+02	·	5.4e+02	+
	(5.0e+00)	(4.8e+00)		(2.3e+00)		(3.0e+01)	
Summary (+/·/−)		0/28/0		9/11/8		9/13/6	

Table 184: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	6.0e−02	5.8e−02	·	2.7e+00	+	5.5e−02	·
	(5.8e−03)	(5.3e−03)		(2.9e−01)		(4.2e−03)	
f_2	1.7e+08	1.8e+08	·	1.6e+08	·	1.7e+08	·
	(2.5e+07)	(2.3e+07)		(2.5e+07)		(2.4e+07)	
f_3	4.8e+10	4.8e+10	·	4.5e+10	·	4.6e+10	·
	(5.2e+09)	(5.7e+09)		(5.2e+09)		(4.7e+09)	
f_4	1.3e+05	1.2e+05	·	1.2e+05	−	1.2e+05	·
	(1.1e+04)	(9.8e+03)		(8.2e+03)		(1.0e+04)	
f_5	2.2e−01	2.3e−01	·	2.7e+00	+	1.7e−01	−
	(1.6e−02)	(1.9e−02)		(2.2e−01)		(1.5e−02)	
f_6	6.3e+01	5.9e+01	−	7.7e+01	+	8.6e+01	+
	(4.1e+00)	(2.6e+00)		(6.9e+00)		(4.6e+00)	
f_7	1.6e+02	1.6e+02	·	1.5e+02	·	1.6e+02	·
	(7.2e+00)	(1.0e+01)		(9.6e+00)		(6.4e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.6e−02)	(3.8e−02)		(3.9e−02)		(4.3e−02)	
f_9	6.4e+01	6.4e+01	·	6.3e+01	·	6.3e+01	·
	(1.2e+00)	(1.7e+00)		(1.8e+00)		(1.4e+00)	
f_{10}	9.3e+02	9.6e+02	·	9.6e+02	·	8.8e+02	·
	(7.4e+01)	(7.7e+01)		(1.1e+02)		(9.3e+01)	
f_{11}	1.2e+02	1.2e+02	·	4.3e+01	−	1.2e+02	+
	(5.9e+00)	(4.3e+00)		(2.4e+00)		(7.3e+00)	
f_{12}	5.0e+02	5.0e+02	·	5.1e+02	·	4.9e+02	·
	(1.6e+01)	(1.9e+01)		(2.2e+01)		(1.9e+01)	
f_{13}	5.1e+02	5.1e+02	·	5.2e+02	+	5.0e+02	·
	(1.9e+01)	(1.8e+01)		(2.5e+01)		(2.0e+01)	
f_{14}	4.5e+03	3.8e+03	−	2.0e+03	−	4.6e+03	·
	(2.4e+02)	(2.5e+02)		(1.7e+02)		(2.0e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.3e+02)	(2.9e+02)		(3.7e+02)		(3.1e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.3e+00	·	3.3e+00	·
	(3.4e−01)	(2.8e−01)		(3.4e−01)		(2.7e−01)	
f_{17}	1.8e+02	1.9e+02	·	1.2e+02	−	1.9e+02	+
	(6.4e+00)	(6.9e+00)		(4.9e+00)		(7.7e+00)	
f_{18}	5.5e+02	5.4e+02	·	6.0e+02	+	5.5e+02	·
	(1.8e+01)	(2.2e+01)		(1.6e+01)		(1.5e+01)	
f_{19}	2.1e+01	2.1e+01	·	2.6e+01	+	2.0e+01	−
	(1.0e+00)	(1.0e+00)		(1.5e+00)		(7.9e−01)	
f_{20}	2.4e+01	2.4e+01	·	2.3e+01	−	2.4e+01	·
	(2.8e−01)	(2.5e−01)		(2.5e−01)		(2.6e−01)	
f_{21}	1.2e+03	1.0e+03	−	6.1e+02	−	1.3e+03	+
	(7.5e+01)	(6.3e+01)		(3.3e+02)		(7.2e+01)	
f_{22}	5.5e+03	5.2e+03	−	3.9e+03	−	5.6e+03	·
	(2.5e+02)	(2.8e+02)		(3.0e+02)		(2.2e+02)	
f_{23}	1.5e+04	1.5e+04	·	1.4e+04	·	1.4e+04	·
	(3.2e+02)	(3.7e+02)		(4.0e+02)		(3.7e+02)	
f_{24}	3.6e+02	3.6e+02	·	3.6e+02	·	3.6e+02	·
	(3.6e+00)	(5.0e+00)		(5.5e+00)		(3.3e+00)	
f_{25}	4.0e+02	3.9e+02	·	3.9e+02	·	4.0e+02	+
	(3.9e+00)	(3.7e+00)		(5.0e+00)		(5.8e+00)	
f_{26}	2.2e+02	2.2e+02	·	2.2e+02	−	2.2e+02	·
	(2.9e+00)	(2.8e+00)		(2.3e+00)		(2.3e+00)	
f_{27}	1.9e+03	1.9e+03	·	1.9e+03	·	1.9e+03	·
	(4.4e+01)	(4.2e+01)		(4.9e+01)		(4.2e+01)	
f_{28}	5.0e+02	4.7e+02	−	4.3e+02	−	6.5e+02	+
	(3.7e+01)	(2.5e+01)		(6.7e+00)		(2.3e+01)	
Summary (+/·/−)		0/23/5		6/13/9		6/20/2	

Table 185: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	2.7e+03	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(2.6e+02)		(0.0e+00)		(0.0e+00)	
f_2	1.0e+08	1.7e+08	+	1.1e+08	·	1.0e+08	·
	(2.1e+07)	(2.1e+07)		(2.0e+07)		(1.8e+07)	
f_3	1.3e+10	4.6e+10	+	1.3e+10	·	1.3e+10	·
	(2.5e+09)	(5.4e+09)		(3.2e+09)		(2.9e+09)	
f_4	9.8e+04	1.3e+05	+	9.8e+04	·	9.6e+04	·
	(7.8e+03)	(9.3e+03)		(8.3e+03)		(9.8e+03)	
f_5	6.8e−08	2.8e+02	+	6.7e−08	·	1.3e−07	+
	(1.7e−08)	(2.7e+01)		(1.7e−08)		(2.5e−08)	
f_6	4.7e+01	2.4e+02	+	4.7e+01	·	4.7e+01	·
	(8.3e−01)	(2.0e+01)		(8.3e−01)		(7.1e−01)	
f_7	1.2e+02	1.5e+02	+	1.2e+02	·	1.2e+02	·
	(9.6e+00)	(8.0e+00)		(9.1e+00)		(1.2e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.5e−02)	(4.3e−02)		(3.8e−02)		(4.3e−02)	
f_9	6.2e+01	6.4e+01	+	6.1e+01	·	6.1e+01	·
	(2.7e+00)	(1.7e+00)		(2.7e+00)		(2.4e+00)	
f_{10}	1.0e+02	9.8e+02	+	1.0e+02	·	1.5e+02	+
	(2.1e+01)	(1.1e+02)		(2.2e+01)		(2.7e+01)	
f_{11}	4.0e+01	2.1e+02	+	3.6e+01	·	9.3e+01	+
	(4.9e+00)	(1.0e+01)		(7.4e+00)		(4.9e+00)	
f_{12}	3.8e+02	5.2e+02	+	3.8e+02	·	3.9e+02	·
	(2.3e+01)	(1.9e+01)		(2.5e+01)		(2.1e+01)	
f_{13}	4.1e+02	5.3e+02	+	4.1e+02	·	4.1e+02	·
	(1.6e+01)	(2.2e+01)		(2.1e+01)		(2.0e+01)	
f_{14}	2.1e+03	4.3e+03	+	2.1e+03	·	4.2e+03	+
	(2.9e+02)	(2.4e+02)		(2.7e+02)		(2.5e+02)	
f_{15}	1.3e+04	1.4e+04	·	1.3e+04	·	1.3e+04	·
	(3.6e+02)	(3.7e+02)		(4.9e+02)		(4.3e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.3e+00	·	3.3e+00	·
	(2.8e−01)	(3.0e−01)		(2.8e−01)		(3.2e−01)	
f_{17}	1.0e+02	4.7e+02	+	1.0e+02	·	1.5e+02	+
	(3.8e+00)	(1.8e+01)		(3.9e+00)		(5.2e+00)	
f_{18}	4.6e+02	7.1e+02	+	4.6e+02	·	4.6e+02	·
	(1.5e+01)	(2.9e+01)		(1.6e+01)		(1.5e+01)	
f_{19}	1.3e+01	8.7e+01	+	1.3e+01	·	1.3e+01	·
	(7.2e−01)	(1.1e+01)		(8.4e−01)		(8.2e−01)	
f_{20}	2.3e+01	2.4e+01	+	2.3e+01	·	2.3e+01	·
	(2.5e−01)	(3.1e−01)		(2.5e−01)		(2.8e−01)	
f_{21}	7.7e+02	1.8e+03	+	8.0e+02	·	7.2e+02	·
	(4.2e+02)	(1.2e+02)		(4.2e+02)		(4.1e+02)	
f_{22}	2.9e+03	5.2e+03	+	2.9e+03	·	4.4e+03	+
	(4.6e+02)	(2.5e+02)		(5.4e+02)		(2.6e+02)	
f_{23}	1.4e+04	1.5e+04	+	1.4e+04	·	1.4e+04	·
	(3.6e+02)	(3.4e+02)		(5.4e+02)		(5.1e+02)	
f_{24}	3.5e+02	3.6e+02	+	3.5e+02	·	3.5e+02	·
	(8.0e+00)	(4.3e+00)		(6.0e+00)		(6.5e+00)	
f_{25}	3.8e+02	4.0e+02	+	3.8e+02	·	3.8e+02	·
	(6.9e+00)	(4.7e+00)		(5.6e+00)		(5.4e+00)	
f_{26}	2.1e+02	2.2e+02	+	2.1e+02	·	2.1e+02	·
	(2.3e+00)	(2.5e+00)		(1.7e+00)		(2.1e+00)	
f_{27}	1.8e+03	1.9e+03	+	1.8e+03	·	1.8e+03	·
	(7.1e+01)	(4.0e+01)		(5.7e+01)		(6.4e+01)	
f_{28}	5.3e+02	1.1e+03	+	4.6e+02	·	5.3e+02	+
	(6.4e+02)	(4.9e+01)		(4.6e+02)		(6.4e+02)	
Summary (+/·/−)		25/3/0		0/28/0		7/21/0	

Table 186: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	5.3e−05	3.3e+01	+	4.8e−05	·	6.0e−05	·
	(7.7e−06)	(1.1e+01)		(8.0e−06)		(9.9e−06)	
f_2	1.3e+08	1.5e+08	+	1.4e+08	·	1.4e+08	·
	(2.4e+07)	(1.9e+07)		(2.3e+07)		(2.0e+07)	
f_3	2.9e+10	1.8e+10	−	2.9e+10	·	2.8e+10	·
	(4.3e+09)	(3.2e+09)		(3.3e+09)		(3.4e+09)	
f_4	1.1e+05	1.3e+05	+	1.1e+05	·	1.1e+05	·
	(9.4e+03)	(9.8e+03)		(9.6e+03)		(8.1e+03)	
f_5	2.0e−03	1.3e+01	+	2.0e−03	·	2.1e−03	·
	(2.6e−04)	(4.9e+00)		(2.9e−04)		(3.2e−04)	
f_6	4.7e+01	5.0e+01	+	4.7e+01	·	4.8e+01	+
	(6.3e−01)	(5.8e−01)		(4.8e−01)		(7.6e−01)	
f_7	1.3e+02	1.4e+02	·	1.4e+02	·	1.4e+02	·
	(8.5e+00)	(7.5e+00)		(9.0e+00)		(7.5e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.4e−02)	(3.9e−02)		(4.8e−02)		(3.9e−02)	
f_9	6.2e+01	6.4e+01	+	6.3e+01	·	6.3e+01	·
	(1.9e+00)	(1.8e+00)		(1.7e+00)		(1.6e+00)	
f_{10}	4.6e+02	1.6e+02	−	4.8e+02	·	5.1e+02	·
	(5.7e+01)	(2.5e+01)		(6.1e+01)		(6.8e+01)	
f_{11}	9.9e+01	2.1e+01	−	9.1e+01	−	1.1e+02	+
	(4.8e+00)	(2.9e+00)		(6.3e+00)		(6.3e+00)	
f_{12}	4.5e+02	4.0e+02	−	4.4e+02	·	4.5e+02	·
	(2.2e+01)	(1.6e+01)		(1.8e+01)		(1.9e+01)	
f_{13}	4.6e+02	4.1e+02	−	4.6e+02	·	4.6e+02	·
	(2.0e+01)	(1.6e+01)		(1.8e+01)		(2.0e+01)	
f_{14}	4.2e+03	6.3e+01	−	3.1e+03	−	4.4e+03	+
	(2.4e+02)	(1.2e+01)		(2.2e+02)		(2.1e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.3e+02)	(3.7e+02)		(4.0e+02)		(3.7e+02)	
f_{16}	3.2e+00	3.4e+00	·	3.2e+00	·	3.3e+00	·
	(3.1e−01)	(2.6e−01)		(3.3e−01)		(3.3e−01)	
f_{17}	1.6e+02	9.1e+01	−	1.6e+02	·	1.7e+02	+
	(5.3e+00)	(5.0e+00)		(6.6e+00)		(5.9e+00)	
f_{18}	5.1e+02	4.6e+02	−	5.1e+02	·	5.1e+02	·
	(1.9e+01)	(1.5e+01)		(1.7e+01)		(1.5e+01)	
f_{19}	1.7e+01	4.4e+00	−	1.7e+01	·	1.7e+01	·
	(1.0e+00)	(8.5e−01)		(8.2e−01)		(1.1e+00)	
f_{20}	2.3e+01	2.4e+01	+	2.3e+01	·	2.3e+01	·
	(3.3e−01)	(2.9e−01)		(2.6e−01)		(2.5e−01)	
f_{21}	5.8e+02	9.2e+02	+	6.5e+02	·	7.8e+02	+
	(4.1e+02)	(2.4e+02)		(4.3e+02)		(3.8e+02)	
f_{22}	4.7e+03	1.4e+02	−	3.7e+03	−	4.8e+03	·
	(3.0e+02)	(2.6e+01)		(3.5e+02)		(2.3e+02)	
f_{23}	1.4e+04	1.5e+04	+	1.4e+04	·	1.4e+04	·
	(4.1e+02)	(3.3e+02)		(4.6e+02)		(4.3e+02)	
f_{24}	3.6e+02	3.6e+02	·	3.5e+02	·	3.5e+02	·
	(6.1e+00)	(3.8e+00)		(4.3e+00)		(5.1e+00)	
f_{25}	3.9e+02	3.8e+02	·	3.9e+02	·	3.9e+02	·
	(4.5e+00)	(4.3e+00)		(6.0e+00)		(5.2e+00)	
f_{26}	2.1e+02	2.2e+02	+	2.1e+02	·	2.1e+02	·
	(2.2e+00)	(3.1e+00)		(2.1e+00)		(2.3e+00)	
f_{27}	1.9e+03	1.9e+03	·	1.9e+03	·	1.9e+03	·
	(5.9e+01)	(4.6e+01)		(4.5e+01)		(5.2e+01)	
f_{28}	4.1e+02	4.6e+02	+	4.0e+02	·	4.9e+02	+
	(4.0e+01)	(9.0e+00)		(4.4e+00)		(4.7e+02)	
Summary (+/·/−)		11/7/10		0/25/3		6/22/0	

Table 187: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.2e−08	3.3e+01	+	4.7e−05	+	0.0e+00	−
	(2.7e−09)	(9.3e+00)		(7.1e−06)		(0.0e+00)	
f_2	8.3e+07	1.5e+08	+	1.3e+08	+	1.2e+08	+
	(1.2e+07)	(1.8e+07)		(1.9e+07)		(1.3e+07)	
f_3	1.4e+10	1.9e+10	+	2.8e+10	+	1.9e+10	+
	(1.9e+09)	(2.4e+09)		(3.7e+09)		(2.1e+09)	
f_4	1.1e+05	1.3e+05	+	1.1e+05	·	1.1e+05	·
	(8.6e+03)	(9.6e+03)		(9.3e+03)		(8.6e+03)	
f_5	5.8e−06	1.2e+01	+	2.0e−03	+	1.3e−07	−
	(6.7e−07)	(3.2e+00)		(2.4e−04)		(1.5e−08)	
f_6	4.8e+01	5.0e+01	+	4.7e+01	−	4.8e+01	+
	(1.8e−01)	(7.0e−01)		(6.0e−01)		(2.3e−01)	
f_7	1.2e+02	1.4e+02	+	1.4e+02	+	1.2e+02	·
	(7.8e+00)	(7.9e+00)		(9.8e+00)		(6.5e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.0e−02)	(3.4e−02)		(3.3e−02)		(3.9e−02)	
f_9	6.0e+01	6.4e+01	+	6.2e+01	+	6.3e+01	+
	(1.6e+00)	(1.6e+00)		(2.2e+00)		(1.7e+00)	
f_{10}	5.2e+01	1.6e+02	+	4.7e+02	+	1.9e+02	+
	(3.5e+00)	(2.0e+01)		(7.3e+01)		(1.6e+01)	
f_{11}	5.8e+01	2.1e+01	−	9.1e+01	+	7.7e+01	+
	(4.5e+00)	(3.4e+00)		(6.2e+00)		(5.5e+00)	
f_{12}	4.3e+02	4.0e+02	−	4.4e+02	·	4.0e+02	−
	(1.7e+01)	(1.7e+01)		(2.1e+01)		(1.8e+01)	
f_{13}	4.5e+02	4.2e+02	−	4.6e+02	·	4.2e+02	−
	(1.8e+01)	(1.4e+01)		(1.8e+01)		(1.3e+01)	
f_{14}	4.4e+03	6.3e+01	−	3.0e+03	−	4.2e+03	−
	(2.7e+02)	(1.4e+01)		(2.4e+02)		(2.0e+02)	
f_{15}	1.3e+04	1.4e+04	·	1.3e+04	·	1.4e+04	·
	(4.4e+02)	(4.7e+02)		(4.3e+02)		(3.6e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.4e+00	·	3.3e+00	·
	(2.7e−01)	(3.1e−01)		(2.8e−01)		(3.2e−01)	
f_{17}	1.1e+02	8.9e+01	−	1.6e+02	+	1.3e+02	+
	(3.8e+00)	(5.1e+00)		(7.2e+00)		(4.8e+00)	
f_{18}	4.7e+02	4.6e+02	−	5.1e+02	+	4.5e+02	−
	(1.4e+01)	(1.5e+01)		(2.2e+01)		(1.4e+01)	
f_{19}	1.1e+01	4.3e+00	−	1.7e+01	+	1.2e+01	+
	(7.6e−01)	(7.9e−01)		(9.4e−01)		(6.8e−01)	
f_{20}	2.4e+01	2.4e+01	·	2.3e+01	−	2.4e+01	·
	(3.4e−01)	(2.9e−01)		(2.5e−01)		(2.6e−01)	
f_{21}	1.1e+03	9.2e+02	·	3.5e+02	−	1.2e+03	+
	(1.5e+02)	(2.4e+02)		(3.3e+02)		(2.1e+01)	
f_{22}	5.1e+03	1.5e+02	−	3.8e+03	−	5.0e+03	·
	(2.5e+02)	(2.6e+01)		(3.7e+02)		(3.1e+02)	
f_{23}	1.4e+04	1.5e+04	·	1.4e+04	·	1.5e+04	·
	(4.3e+02)	(4.2e+02)		(5.4e+02)		(4.3e+02)	
f_{24}	3.4e+02	3.5e+02	+	3.5e+02	+	3.4e+02	·
	(6.5e+00)	(4.7e+00)		(4.3e+00)		(5.1e+00)	
f_{25}	4.0e+02	3.8e+02	−	3.9e+02	−	4.0e+02	·
	(5.0e+00)	(5.1e+00)		(5.9e+00)		(4.4e+00)	
f_{26}	2.1e+02	2.2e+02	+	2.1e+02	+	2.1e+02	+
	(1.4e+00)	(3.2e+00)		(1.8e+00)		(1.9e+00)	
f_{27}	1.8e+03	1.9e+03	+	1.9e+03	·	1.9e+03	·
	(5.6e+01)	(5.2e+01)		(5.2e+01)		(4.9e+01)	
f_{28}	4.0e+02	4.6e+02	+	4.0e+02	+	4.4e+02	+
	(7.0e−02)	(1.1e+01)		(1.3e−01)		(1.2e+01)	
Summary (+/·/−)		13/6/9		14/8/6		11/11/6	

Table 188: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	8.6e+02	+	1.2e−07	+	0.0e+00	·
	(0.0e+00)	(9.5e+01)		(2.7e−08)		(0.0e+00)	
f_2	6.2e+07	1.6e+08	+	1.2e+08	+	1.1e+08	+
	(1.1e+07)	(1.9e+07)		(2.2e+07)		(1.9e+07)	
f_3	5.4e+09	3.2e+10	+	2.1e+10	+	1.5e+10	+
	(1.3e+09)	(4.2e+09)		(3.4e+09)		(2.7e+09)	
f_4	9.5e+04	1.3e+05	+	1.0e+05	+	9.5e+04	·
	(8.1e+03)	(8.4e+03)		(9.2e+03)		(9.3e+03)	
f_5	2.1e−07	1.2e+02	+	3.2e−05	+	2.8e−07	+
	(4.9e−08)	(8.1e+00)		(5.8e−06)		(4.2e−08)	
f_6	4.7e+01	1.2e+02	+	4.7e+01	·	4.7e+01	·
	(7.4e−01)	(5.5e+00)		(7.3e−01)		(6.5e−01)	
f_7	1.0e+02	1.4e+02	+	1.3e+02	+	1.1e+02	+
	(7.2e+00)	(7.9e+00)		(9.3e+00)		(8.6e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.3e−02)	(4.1e−02)		(3.2e−02)		(3.6e−02)	
f_9	6.0e+01	6.4e+01	+	6.2e+01	+	6.2e+01	+
	(1.4e+00)	(1.6e+00)		(2.5e+00)		(1.9e+00)	
f_{10}	6.1e+00	5.9e+02	+	2.7e+02	+	1.8e+02	+
	(1.3e+00)	(5.5e+01)		(6.3e+01)		(3.0e+01)	
f_{11}	5.2e+01	1.4e+02	+	7.3e+01	+	8.6e+01	+
	(2.6e+00)	(7.8e+00)		(7.5e+00)		(4.7e+00)	
f_{12}	3.9e+02	4.6e+02	+	4.2e+02	+	3.9e+02	·
	(1.8e+01)	(1.8e+01)		(2.2e+01)		(2.1e+01)	
f_{13}	4.1e+02	4.7e+02	+	4.4e+02	+	4.2e+02	·
	(2.2e+01)	(1.5e+01)		(1.9e+01)		(1.7e+01)	
f_{14}	4.2e+03	3.8e+03	−	3.0e+03	−	4.2e+03	·
	(2.6e+02)	(2.4e+02)		(2.6e+02)		(1.9e+02)	
f_{15}	1.3e+04	1.4e+04	+	1.4e+04	·	1.4e+04	·
	(5.0e+02)	(2.8e+02)		(4.4e+02)		(4.5e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.3e+00	·	3.2e+00	·
	(3.1e−01)	(3.3e−01)		(2.8e−01)		(3.1e−01)	
f_{17}	1.0e+02	2.9e+02	+	1.5e+02	+	1.4e+02	+
	(3.2e+00)	(1.4e+01)		(5.5e+00)		(4.6e+00)	
f_{18}	4.6e+02	5.8e+02	+	4.8e+02	+	4.6e+02	·
	(1.3e+01)	(2.0e+01)		(1.4e+01)		(1.1e+01)	
f_{19}	1.2e+01	3.8e+01	+	1.5e+01	+	1.3e+01	+
	(6.7e−01)	(2.5e+00)		(8.8e−01)		(7.9e−01)	
f_{20}	2.3e+01	2.4e+01	+	2.3e+01	·	2.3e+01	−
	(2.3e−01)	(3.1e−01)		(2.1e−01)		(3.0e−01)	
f_{21}	7.2e+02	1.5e+03	+	6.1e+02	·	7.6e+02	+
	(4.1e+02)	(1.1e+02)		(4.4e+02)		(4.0e+02)	
f_{22}	4.4e+03	4.8e+03	+	3.7e+03	−	4.5e+03	·
	(3.6e+02)	(2.7e+02)		(3.3e+02)		(2.6e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(4.3e+02)	(4.0e+02)		(4.9e+02)		(4.1e+02)	
f_{24}	3.3e+02	3.6e+02	+	3.5e+02	+	3.4e+02	+
	(8.1e+00)	(4.0e+00)		(6.5e+00)		(6.9e+00)	
f_{25}	3.9e+02	3.9e+02	·	3.8e+02	·	3.8e+02	·
	(6.8e+00)	(4.2e+00)		(5.6e+00)		(7.2e+00)	
f_{26}	2.1e+02	2.2e+02	+	2.1e+02	+	2.1e+02	+
	(1.1e+00)	(2.6e+00)		(2.5e+00)		(2.0e+00)	
f_{27}	1.8e+03	1.9e+03	+	1.9e+03	+	1.9e+03	+
	(5.9e+01)	(4.3e+01)		(5.7e+01)		(5.5e+01)	
f_{28}	4.6e+02	7.4e+02	+	5.3e+02	+	4.0e+02	+
	(4.5e+02)	(2.4e+01)		(6.5e+02)		(6.1e+00)	
Summary (+/·/−)		23/4/1		18/8/2		14/13/1	

Table 189: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.4e−05	1.4e−05	·	3.1e−02	+	1.6e−05	+
	(1.6e−06)	(1.5e−06)		(3.9e−03)		(1.8e−06)	
f_2	1.6e+08	1.7e+08	·	1.5e+08	·	1.5e+08	·
	(2.1e+07)	(2.3e+07)		(2.2e+07)		(1.9e+07)	
f_3	3.6e+10	3.6e+10	·	3.6e+10	·	3.4e+10	·
	(4.0e+09)	(4.8e+09)		(4.9e+09)		(3.1e+09)	
f_4	1.2e+05	1.3e+05	·	1.1e+05	−	1.2e+05	·
	(1.0e+04)	(9.6e+03)		(9.9e+03)		(9.3e+03)	
f_5	7.5e−04	8.8e−04	+	1.5e−01	+	6.4e−04	−
	(6.8e−05)	(8.6e−05)		(1.6e−02)		(7.0e−05)	
f_6	4.8e+01	4.8e+01	·	4.8e+01	+	5.0e+01	+
	(1.2e−01)	(1.0e−01)		(9.3e−01)		(9.3e−01)	
f_7	1.5e+02	1.5e+02	·	1.5e+02	·	1.4e+02	−
	(8.1e+00)	(9.0e+00)		(8.8e+00)		(6.9e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.3e−02)	(3.6e−02)		(4.0e−02)		(3.7e−02)	
f_9	6.3e+01	6.4e+01	·	6.3e+01	·	6.4e+01	·
	(1.5e+00)	(1.5e+00)		(1.9e+00)		(1.3e+00)	
f_{10}	5.7e+02	5.9e+02	·	7.2e+02	+	5.2e+02	·
	(6.5e+01)	(5.0e+01)		(9.4e+01)		(5.5e+01)	
f_{11}	8.8e+01	8.0e+01	−	8.0e+01	−	9.8e+01	+
	(5.0e+00)	(4.1e+00)		(5.0e+00)		(5.5e+00)	
f_{12}	4.5e+02	4.5e+02	·	4.8e+02	+	4.5e+02	·
	(2.2e+01)	(2.0e+01)		(2.0e+01)		(1.5e+01)	
f_{13}	4.6e+02	4.6e+02	·	5.0e+02	+	4.6e+02	·
	(1.7e+01)	(1.9e+01)		(1.7e+01)		(2.1e+01)	
f_{14}	3.7e+03	3.4e+03	−	3.4e+03	−	4.5e+03	+
	(2.0e+02)	(2.1e+02)		(2.5e+02)		(2.5e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.9e+02)	(3.2e+02)		(3.1e+02)		(3.5e+02)	
f_{16}	3.3e+00	3.2e+00	·	3.3e+00	·	3.3e+00	·
	(2.9e−01)	(3.6e−01)		(2.4e−01)		(2.9e−01)	
f_{17}	1.5e+02	1.5e+02	·	1.9e+02	+	1.6e+02	+
	(5.1e+00)	(5.0e+00)		(7.6e+00)		(4.0e+00)	
f_{18}	5.0e+02	5.0e+02	·	5.5e+02	+	5.0e+02	·
	(1.7e+01)	(1.5e+01)		(1.8e+01)		(2.2e+01)	
f_{19}	1.6e+01	1.6e+01	·	2.1e+01	+	1.6e+01	·
	(8.7e−01)	(9.3e−01)		(1.2e+00)		(8.7e−01)	
f_{20}	2.4e+01	2.4e+01	·	2.3e+01	−	2.4e+01	·
	(2.4e−01)	(2.6e−01)		(2.9e−01)		(2.6e−01)	
f_{21}	9.7e+02	7.2e+02	−	5.1e+02	−	1.2e+03	+
	(1.2e+02)	(1.2e+02)		(4.0e+02)		(1.6e+02)	
f_{22}	5.1e+03	4.8e+03	−	4.1e+03	−	5.3e+03	·
	(2.3e+02)	(3.1e+02)		(3.4e+02)		(2.2e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.5e+04	·
	(3.7e+02)	(4.6e+02)		(4.4e+02)		(3.0e+02)	
f_{24}	3.6e+02	3.6e+02	·	3.6e+02	·	3.5e+02	·
	(4.2e+00)	(4.3e+00)		(5.7e+00)		(4.5e+00)	
f_{25}	3.9e+02	3.9e+02	·	3.9e+02	·	4.0e+02	+
	(5.4e+00)	(4.8e+00)		(6.2e+00)		(4.5e+00)	
f_{26}	2.2e+02	2.2e+02	·	2.1e+02	−	2.2e+02	−
	(2.9e+00)	(2.6e+00)		(2.7e+00)		(2.0e+00)	
f_{27}	1.9e+03	1.9e+03	·	1.9e+03	·	1.9e+03	·
	(5.3e+01)	(3.6e+01)		(5.5e+01)		(4.9e+01)	
f_{28}	4.0e+02	4.0e+02	+	4.0e+02	+	5.2e+02	+
	(1.1e+00)	(2.0e+00)		(5.1e+00)		(2.2e+01)	
Summary (+/·/−)		2/22/4		10/11/7		8/17/3	

Table 190: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	1.8e−04	+	6.3e−04	+
	(0.0e+00)	(0.0e+00)		(2.9e−05)		(1.0e−04)	
f_2	7.4e+07	1.6e+08	+	1.4e+08	+	1.4e+08	+
	(8.7e+06)	(1.8e+07)		(2.3e+07)		(2.4e+07)	
f_3	5.7e+09	2.2e+10	+	2.9e+10	+	3.0e+10	+
	(7.4e+08)	(3.1e+09)		(5.0e+09)		(3.9e+09)	
f_4	9.7e+04	1.2e+05	+	1.1e+05	+	1.0e+05	·
	(1.1e+04)	(1.1e+04)		(9.5e+03)		(1.1e+04)	
f_5	3.0e−07	4.9e−07	+	4.6e−03	+	1.1e−02	+
	(3.5e−08)	(5.2e−08)		(5.3e−04)		(1.7e−03)	
f_6	4.7e+01	4.8e+01	+	4.7e+01	·	4.8e+01	+
	(3.8e−01)	(2.1e−01)		(6.6e−01)		(8.6e−01)	
f_7	1.1e+02	1.4e+02	+	1.4e+02	+	1.4e+02	+
	(7.8e+00)	(7.3e+00)		(8.4e+00)		(8.8e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.2e−02)	(3.7e−02)		(3.4e−02)		(3.4e−02)	
f_9	6.0e+01	6.4e+01	+	6.3e+01	+	6.3e+01	+
	(1.5e+00)	(1.5e+00)		(2.0e+00)		(2.0e+00)	
f_{10}	1.3e+01	2.3e+02	+	5.2e+02	+	5.7e+02	+
	(1.7e+00)	(2.8e+01)		(7.1e+01)		(7.4e+01)	
f_{11}	4.9e+01	6.3e+00	−	9.4e+01	+	1.2e+02	+
	(3.8e+00)	(3.6e+00)		(5.6e+00)		(5.7e+00)	
f_{12}	3.9e+02	4.1e+02	+	4.5e+02	+	4.6e+02	+
	(2.3e+01)	(1.5e+01)		(2.1e+01)		(2.1e+01)	
f_{13}	4.2e+02	4.2e+02	·	4.7e+02	+	4.7e+02	+
	(1.4e+01)	(2.0e+01)		(2.1e+01)		(1.9e+01)	
f_{14}	4.2e+03	1.9e+03	−	3.0e+03	−	4.4e+03	+
	(2.4e+02)	(1.6e+02)		(2.6e+02)		(2.1e+02)	
f_{15}	1.3e+04	1.4e+04	+	1.4e+04	+	1.4e+04	+
	(3.5e+02)	(2.8e+02)		(4.5e+02)		(3.6e+02)	
f_{16}	3.2e+00	3.3e+00	·	3.3e+00	·	3.3e+00	·
	(3.7e−01)	(3.2e−01)		(3.1e−01)		(2.5e−01)	
f_{17}	1.0e+02	1.3e+02	+	1.7e+02	+	1.8e+02	+
	(3.7e+00)	(4.4e+00)		(5.7e+00)		(6.3e+00)	
f_{18}	4.6e+02	4.6e+02	·	5.2e+02	+	5.2e+02	+
	(1.5e+01)	(1.4e+01)		(1.5e+01)		(2.0e+01)	
f_{19}	1.2e+01	1.1e+01	·	1.7e+01	+	1.8e+01	+
	(6.7e−01)	(7.9e−01)		(1.0e+00)		(9.9e−01)	
f_{20}	2.3e+01	2.4e+01	+	2.3e+01	·	2.3e+01	·
	(3.0e−01)	(2.5e−01)		(3.0e−01)		(3.0e−01)	
f_{21}	7.6e+02	8.5e+02	·	5.5e+02	·	5.8e+02	·
	(4.3e+02)	(2.6e+02)		(4.2e+02)		(3.7e+02)	
f_{22}	4.4e+03	4.0e+03	−	3.8e+03	−	4.8e+03	+
	(2.5e+02)	(2.8e+02)		(3.6e+02)		(2.3e+02)	
f_{23}	1.4e+04	1.5e+04	·	1.4e+04	·	1.4e+04	·
	(4.4e+02)	(2.8e+02)		(4.4e+02)		(4.6e+02)	
f_{24}	3.3e+02	3.5e+02	+	3.5e+02	+	3.6e+02	+
	(6.6e+00)	(4.3e+00)		(4.6e+00)		(5.4e+00)	
f_{25}	3.9e+02	3.8e+02	−	3.9e+02	−	3.9e+02	·
	(6.2e+00)	(4.5e+00)		(5.2e+00)		(5.0e+00)	
f_{26}	2.1e+02	2.2e+02	+	2.1e+02	+	2.1e+02	+
	(9.3e−01)	(2.4e+00)		(2.5e+00)		(2.1e+00)	
f_{27}	1.8e+03	1.9e+03	+	1.9e+03	+	1.9e+03	+
	(4.0e+01)	(4.9e+01)		(4.7e+01)		(5.1e+01)	
f_{28}	4.0e+02	4.0e+02	+	4.0e+02	+	4.3e+02	+
	(5.5e−05)	(1.9e−02)		(2.1e−01)		(4.0e+01)	
Summary (+/·/−)		16/8/4		19/6/3		21/7/0	

Table 191: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	9.7e−05	1.0e−04	·	1.2e+01	+	2.8e−05	−
	(1.2e−05)	(1.0e−05)		(2.7e+00)		(3.1e−06)	
f_2	3.9e+08	4.1e+08	·	3.5e+08	−	3.6e+08	−
	(5.0e+07)	(5.3e+07)		(5.1e+07)		(4.8e+07)	
f_3	2.4e+10	2.4e+10	·	4.5e+10	+	2.4e+10	·
	(2.2e+09)	(2.7e+09)		(4.8e+09)		(2.5e+09)	
f_4	1.2e+05	1.2e+05	·	9.7e+04	−	1.1e+05	−
	(9.3e+03)	(8.4e+03)		(1.1e+04)		(9.6e+03)	
f_5	1.1e−02	1.1e−02	·	1.1e+01	+	2.0e−03	−
	(1.0e−03)	(9.6e−04)		(1.6e+00)		(1.6e−04)	
f_6	4.7e+01	4.7e+01	·	5.9e+01	+	4.7e+01	−
	(1.1e−01)	(1.3e−01)		(3.5e+00)		(1.1e−01)	
f_7	1.3e+02	1.3e+02	·	1.5e+02	+	1.2e+02	−
	(5.6e+00)	(8.0e+00)		(9.5e+00)		(5.1e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.5e−02)	(4.0e−02)		(3.4e−02)		(3.7e−02)	
f_9	7.2e+01	7.2e+01	·	7.2e+01	·	7.2e+01	·
	(1.5e+00)	(1.3e+00)		(1.5e+00)		(1.5e+00)	
f_{10}	1.1e+03	1.0e+03	·	1.7e+03	+	9.1e+02	−
	(1.1e+02)	(1.2e+02)		(1.7e+02)		(9.8e+01)	
f_{11}	2.0e+02	2.0e+02	·	2.0e+02	·	2.2e+02	+
	(1.2e+01)	(1.1e+01)		(1.6e+01)		(9.3e+00)	
f_{12}	4.3e+02	4.4e+02	·	4.9e+02	+	4.3e+02	·
	(1.4e+01)	(1.3e+01)		(1.8e+01)		(1.5e+01)	
f_{13}	4.3e+02	4.4e+02	·	5.0e+02	+	4.3e+02	·
	(1.4e+01)	(1.5e+01)		(1.5e+01)		(1.7e+01)	
f_{14}	7.5e+03	7.6e+03	·	5.6e+03	−	8.8e+03	+
	(3.5e+02)	(3.3e+02)		(4.6e+02)		(3.5e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.4e+02)	(3.5e+02)		(3.6e+02)		(3.9e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.3e+00	·	3.4e+00	·
	(3.2e−01)	(2.7e−01)		(3.0e−01)		(2.6e−01)	
f_{17}	2.7e+02	2.6e+02	·	3.2e+02	+	2.9e+02	+
	(1.0e+01)	(1.2e+01)		(2.2e+01)		(9.9e+00)	
f_{18}	4.8e+02	4.7e+02	·	5.6e+02	+	4.7e+02	·
	(1.3e+01)	(1.5e+01)		(2.1e+01)		(1.3e+01)	
f_{19}	2.8e+01	2.8e+01	·	4.5e+01	+	2.7e+01	−
	(1.2e+00)	(1.1e+00)		(3.7e+00)		(1.1e+00)	
f_{20}	2.3e+01	2.3e+01	·	2.3e+01	·	2.3e+01	+
	(1.7e−01)	(1.9e−01)		(2.2e−01)		(2.4e−01)	
f_{21}	6.7e+02	6.6e+02	·	8.3e+02	·	1.3e+03	+
	(1.1e+02)	(1.5e+02)		(5.6e+02)		(1.4e+02)	
f_{22}	8.7e+03	8.7e+03	·	6.1e+03	−	9.6e+03	+
	(4.7e+02)	(4.3e+02)		(5.0e+02)		(3.0e+02)	
f_{23}	1.5e+04	1.5e+04	·	1.4e+04	−	1.5e+04	·
	(3.3e+02)	(5.2e+02)		(3.8e+02)		(3.7e+02)	
f_{24}	3.7e+02	3.7e+02	·	3.7e+02	·	3.6e+02	−
	(4.4e+00)	(3.7e+00)		(5.7e+00)		(4.4e+00)	
f_{25}	4.0e+02	4.0e+02	·	4.0e+02	·	4.1e+02	+
	(3.6e+00)	(4.8e+00)		(5.1e+00)		(4.5e+00)	
f_{26}	2.8e+02	2.8e+02	·	2.5e+02	−	2.7e+02	·
	(1.3e+01)	(1.4e+01)		(3.4e+01)		(1.2e+01)	
f_{27}	2.1e+03	2.1e+03	·	2.1e+03	·	2.0e+03	−
	(4.8e+01)	(4.2e+01)		(5.2e+01)		(4.1e+01)	
f_{28}	4.0e+02	4.0e+02	·	5.0e+02	+	4.0e+02	−
	(3.6e−02)	(2.1e−02)		(4.8e+02)		(6.4e+00)	
Summary (+/·/−)		0/28/0		12/10/6		7/10/11	

Table 192: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.6e+01	1.5e+01	−	6.6e+02	+	1.1e+01	−
	(1.3e+00)	(1.2e+00)		(9.0e+01)		(9.9e−01)	
f_2	4.4e+08	4.5e+08	·	4.1e+08	·	4.2e+08	·
	(5.5e+07)	(5.6e+07)		(5.1e+07)		(4.5e+07)	
f_3	5.2e+10	5.1e+10	·	6.0e+10	+	5.2e+10	·
	(4.2e+09)	(4.0e+09)		(5.7e+09)		(5.0e+09)	
f_4	1.3e+05	1.3e+05	·	1.0e+05	−	1.2e+05	·
	(1.1e+04)	(1.1e+04)		(1.0e+04)		(1.1e+04)	
f_5	1.2e+01	1.2e+01	·	8.4e+01	+	7.5e+00	−
	(7.7e−01)	(9.0e−01)		(6.7e+00)		(4.3e−01)	
f_6	8.5e+01	7.8e+01	−	2.4e+02	+	9.6e+01	+
	(4.5e+00)	(3.7e+00)		(3.3e+01)		(7.0e+00)	
f_7	1.6e+02	1.5e+02	·	1.6e+02	·	1.6e+02	·
	(6.0e+00)	(8.3e+00)		(1.1e+01)		(7.0e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.5e−02)	(3.9e−02)		(3.4e−02)		(3.6e−02)	
f_9	7.2e+01	7.2e+01	·	7.2e+01	·	7.2e+01	·
	(1.2e+00)	(1.3e+00)		(1.4e+00)		(1.5e+00)	
f_{10}	2.3e+03	2.1e+03	·	2.2e+03	·	2.1e+03	−
	(1.7e+02)	(1.8e+02)		(2.6e+02)		(1.8e+02)	
f_{11}	2.8e+02	2.5e+02	−	2.0e+02	−	2.8e+02	·
	(1.2e+01)	(1.1e+01)		(1.6e+01)		(1.0e+01)	
f_{12}	5.0e+02	5.0e+02	·	5.5e+02	+	5.0e+02	·
	(1.9e+01)	(2.3e+01)		(1.9e+01)		(2.0e+01)	
f_{13}	5.1e+02	5.0e+02	·	5.5e+02	+	5.1e+02	·
	(1.6e+01)	(1.8e+01)		(1.6e+01)		(1.8e+01)	
f_{14}	9.0e+03	7.8e+03	−	4.5e+03	−	9.0e+03	·
	(2.9e+02)	(3.4e+02)		(5.0e+02)		(3.1e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.8e+02)	(3.3e+02)		(4.4e+02)		(3.0e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.4e+00	·	3.3e+00	·
	(2.5e−01)	(3.0e−01)		(2.6e−01)		(3.4e−01)	
f_{17}	3.7e+02	3.5e+02	−	4.2e+02	+	3.7e+02	·
	(1.2e+01)	(1.4e+01)		(3.0e+01)		(1.1e+01)	
f_{18}	5.6e+02	5.5e+02	·	6.6e+02	+	5.6e+02	·
	(1.7e+01)	(1.7e+01)		(2.4e+01)		(1.3e+01)	
f_{19}	4.9e+01	4.9e+01	·	1.6e+02	+	4.2e+01	−
	(2.3e+00)	(2.5e+00)		(5.1e+01)		(2.7e+00)	
f_{20}	2.3e+01	2.3e+01	·	2.3e+01	−	2.4e+01	+
	(2.0e−01)	(2.3e−01)		(2.3e−01)		(2.4e−01)	
f_{21}	1.7e+03	1.6e+03	−	1.4e+03	·	1.8e+03	+
	(1.3e+02)	(1.5e+02)		(7.7e+02)		(1.0e+02)	
f_{22}	9.8e+03	9.1e+03	−	5.5e+03	−	9.9e+03	·
	(2.8e+02)	(4.5e+02)		(5.5e+02)		(3.4e+02)	
f_{23}	1.5e+04	1.5e+04	·	1.4e+04	−	1.5e+04	·
	(3.6e+02)	(3.4e+02)		(4.6e+02)		(3.8e+02)	
f_{24}	3.7e+02	3.7e+02	·	3.8e+02	·	3.7e+02	·
	(4.2e+00)	(4.2e+00)		(4.8e+00)		(4.6e+00)	
f_{25}	4.1e+02	4.1e+02	·	4.1e+02	·	4.1e+02	+
	(3.9e+00)	(4.0e+00)		(4.2e+00)		(3.7e+00)	
f_{26}	2.8e+02	2.8e+02	·	2.5e+02	−	2.8e+02	·
	(1.1e+01)	(1.4e+01)		(3.2e+01)		(1.4e+01)	
f_{27}	2.1e+03	2.1e+03	·	2.1e+03	·	2.1e+03	·
	(3.6e+01)	(4.0e+01)		(3.7e+01)		(3.9e+01)	
f_{28}	4.6e+02	4.5e+02	·	6.9e+02	+	5.0e+02	·
	(9.1e+00)	(5.9e+00)		(4.9e+02)		(5.1e+01)	
Summary (+/·/−)		0/21/7		10/11/7		4/20/4	

Table 193: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	1.4e+04	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.2e+03)		(0.0e+00)		(0.0e+00)	
f_2	1.1e+08	4.5e+08	+	1.0e+08	·	1.2e+08	·
	(2.9e+07)	(6.1e+07)		(2.7e+07)		(2.5e+07)	
f_3	3.0e+09	7.8e+10	+	2.1e+09	·	3.9e+09	+
	(3.3e+09)	(6.9e+09)		(1.6e+09)		(2.7e+09)	
f_4	5.8e+04	1.2e+05	+	5.8e+04	·	5.8e+04	·
	(7.4e+03)	(1.0e+04)		(7.8e+03)		(7.4e+03)	
f_5	0.0e+00	2.1e+03	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(1.8e+02)		(0.0e+00)		(0.0e+00)	
f_6	4.6e+01	9.1e+02	+	4.6e+01	·	4.6e+01	·
	(1.1e+00)	(8.9e+01)		(1.0e+00)		(3.3e+00)	
f_7	6.1e+01	1.8e+02	+	6.4e+01	·	6.6e+01	·
	(1.3e+01)	(6.9e+00)		(1.5e+01)		(1.4e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.9e−02)	(3.5e−02)		(4.1e−02)		(3.2e−02)	
f_9	6.8e+01	7.2e+01	+	6.9e+01	·	6.8e+01	·
	(2.4e+00)	(1.4e+00)		(2.5e+00)		(3.0e+00)	
f_{10}	1.1e+00	3.0e+03	+	1.1e+00	·	6.0e+00	+
	(3.1e−01)	(2.2e+02)		(5.6e−01)		(4.0e+00)	
f_{11}	6.7e+01	4.9e+02	+	6.2e+01	·	1.9e+02	+
	(3.2e+01)	(1.8e+01)		(3.0e+01)		(1.2e+01)	
f_{12}	3.8e+02	6.4e+02	+	3.8e+02	·	3.8e+02	·
	(1.6e+01)	(1.7e+01)		(1.6e+01)		(1.6e+01)	
f_{13}	3.7e+02	6.4e+02	+	3.8e+02	·	3.8e+02	·
	(1.4e+01)	(2.5e+01)		(2.0e+01)		(1.6e+01)	
f_{14}	4.4e+03	8.0e+03	+	4.4e+03	·	8.4e+03	+
	(6.7e+02)	(3.9e+02)		(8.0e+02)		(3.3e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.7e+02)	(3.4e+02)		(3.4e+02)		(3.2e+02)	
f_{16}	3.3e+00	3.4e+00	·	3.4e+00	·	3.4e+00	·
	(3.3e−01)	(2.8e−01)		(2.6e−01)		(2.6e−01)	
f_{17}	1.8e+02	1.1e+03	+	1.9e+02	·	2.5e+02	+
	(1.2e+01)	(6.3e+01)		(1.3e+01)		(1.5e+01)	
f_{18}	4.2e+02	1.1e+03	+	4.2e+02	·	4.3e+02	·
	(1.4e+01)	(5.1e+01)		(1.6e+01)		(1.7e+01)	
f_{19}	2.1e+01	5.9e+03	+	2.2e+01	·	2.2e+01	·
	(1.8e+00)	(1.2e+03)		(1.2e+00)		(1.1e+00)	
f_{20}	2.2e+01	2.3e+01	+	2.2e+01	·	2.2e+01	·
	(2.5e−01)	(2.1e−01)		(2.7e−01)		(2.7e−01)	
f_{21}	7.3e+02	3.1e+03	+	7.0e+02	·	8.2e+02	+
	(4.5e+02)	(2.8e+02)		(4.4e+02)		(4.3e+02)	
f_{22}	4.0e+03	9.2e+03	+	4.0e+03	·	8.3e+03	+
	(8.9e+02)	(4.5e+02)		(9.4e+02)		(4.4e+02)	
f_{23}	1.4e+04	1.5e+04	+	1.4e+04	·	1.4e+04	·
	(4.5e+02)	(3.1e+02)		(4.6e+02)		(4.8e+02)	
f_{24}	3.0e+02	3.8e+02	+	3.0e+02	·	3.1e+02	·
	(2.3e+01)	(5.0e+00)		(2.7e+01)		(1.6e+01)	
f_{25}	3.2e+02	4.2e+02	+	3.2e+02	·	3.5e+02	+
	(2.2e+01)	(4.5e+00)		(2.3e+01)		(1.5e+01)	
f_{26}	3.0e+02	2.8e+02	·	3.0e+02	·	2.8e+02	·
	(1.1e+02)	(1.4e+01)		(1.1e+02)		(1.1e+02)	
f_{27}	1.7e+03	2.1e+03	+	1.6e+03	·	1.8e+03	·
	(1.8e+02)	(3.6e+01)		(2.2e+02)		(1.1e+02)	
f_{28}	1.1e+03	2.5e+03	+	9.5e+02	·	1.1e+03	+
	(1.3e+03)	(1.5e+02)		(1.2e+03)		(1.3e+03)	
Summary (+/·/−)		24/4/0		0/28/0		9/19/0	

Table 194: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	3.3e−05	9.2e+01	+	2.5e−05	·	3.3e−05	·
	(9.0e−06)	(2.8e+01)		(7.0e−06)		(1.3e−05)	
f_2	2.7e+08	3.1e+08	·	2.7e+08	·	2.8e+08	·
	(4.2e+07)	(3.9e+07)		(5.0e+07)		(3.7e+07)	
f_3	2.5e+10	1.2e+09	−	2.3e+10	·	2.7e+10	·
	(4.6e+09)	(4.2e+08)		(3.7e+09)		(3.8e+09)	
f_4	8.2e+04	1.2e+05	+	8.4e+04	·	8.2e+04	·
	(8.0e+03)	(1.1e+04)		(9.4e+03)		(8.1e+03)	
f_5	4.9e−03	4.6e+01	+	4.7e−03	·	4.5e−03	·
	(1.3e−03)	(1.8e+01)		(1.3e−03)		(9.8e−04)	
f_6	4.7e+01	5.2e+01	+	4.7e+01	·	4.7e+01	·
	(8.7e−01)	(1.5e+00)		(9.0e−01)		(8.2e−01)	
f_7	1.2e+02	5.4e+01	−	1.2e+02	·	1.2e+02	·
	(8.4e+00)	(4.9e+00)		(9.4e+00)		(9.3e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.8e−02)	(4.2e−02)		(3.3e−02)		(3.6e−02)	
f_9	7.1e+01	7.2e+01	+	7.1e+01	·	7.1e+01	·
	(1.4e+00)	(1.2e+00)		(2.2e+00)		(1.5e+00)	
f_{10}	5.9e+02	5.1e+01	−	5.1e+02	·	6.6e+02	·
	(1.2e+02)	(1.5e+01)		(1.0e+02)		(1.4e+02)	
f_{11}	2.4e+02	3.7e+01	−	1.7e+02	−	2.5e+02	·
	(1.6e+01)	(4.8e+00)		(1.5e+01)		(1.0e+01)	
f_{12}	4.4e+02	3.6e+02	−	4.3e+02	·	4.4e+02	·
	(1.5e+01)	(1.2e+01)		(1.7e+01)		(1.9e+01)	
f_{13}	4.3e+02	3.6e+02	−	4.4e+02	·	4.4e+02	·
	(2.2e+01)	(1.3e+01)		(1.7e+01)		(1.6e+01)	
f_{14}	8.7e+03	1.1e+02	−	5.5e+03	−	8.7e+03	·
	(2.9e+02)	(2.2e+01)		(5.4e+02)		(4.2e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(4.7e+02)	(4.1e+02)		(3.1e+02)		(4.0e+02)	
f_{16}	3.4e+00	3.3e+00	·	3.3e+00	·	3.3e+00	·
	(2.6e−01)	(3.1e−01)		(3.2e−01)		(2.5e−01)	
f_{17}	3.1e+02	1.2e+02	−	2.4e+02	−	3.2e+02	·
	(1.2e+01)	(9.7e+00)		(1.5e+01)		(1.4e+01)	
f_{18}	4.9e+02	4.0e+02	−	4.8e+02	·	4.9e+02	·
	(1.9e+01)	(1.4e+01)		(1.7e+01)		(1.7e+01)	
f_{19}	2.9e+01	8.8e+00	−	2.9e+01	·	2.9e+01	·
	(1.6e+00)	(1.5e+00)		(1.4e+00)		(1.5e+00)	
f_{20}	2.3e+01	2.2e+01	·	2.3e+01	·	2.3e+01	·
	(2.9e−01)	(2.3e−01)		(2.4e−01)		(2.3e−01)	
f_{21}	6.3e+02	1.1e+03	+	7.1e+02	·	7.0e+02	·
	(4.5e+02)	(3.4e+02)		(4.4e+02)		(4.6e+02)	
f_{22}	8.8e+03	2.4e+02	−	5.6e+03	−	8.9e+03	·
	(2.9e+02)	(5.3e+01)		(5.5e+02)		(3.1e+02)	
f_{23}	1.4e+04	1.5e+04	·	1.4e+04	·	1.4e+04	·
	(4.1e+02)	(4.5e+02)		(4.4e+02)		(4.7e+02)	
f_{24}	3.6e+02	3.4e+02	−	3.6e+02	·	3.6e+02	·
	(6.6e+00)	(1.5e+01)		(7.8e+00)		(6.0e+00)	
f_{25}	3.9e+02	3.9e+02	·	3.8e+02	·	3.9e+02	·
	(8.7e+00)	(3.9e+00)		(1.2e+01)		(1.0e+01)	
f_{26}	2.7e+02	2.8e+02	+	2.7e+02	·	2.8e+02	·
	(8.4e+01)	(1.8e+01)		(8.2e+01)		(9.2e+01)	
f_{27}	2.0e+03	2.0e+03	·	2.0e+03	·	2.0e+03	·
	(6.4e+01)	(4.1e+01)		(6.6e+01)		(5.9e+01)	
f_{28}	5.3e+02	5.0e+02	+	5.9e+02	·	5.3e+02	·
	(6.5e+02)	(2.4e+01)		(7.9e+02)		(6.5e+02)	
Summary (+/·/−)		8/8/12		0/24/4		0/28/0	

Table 195: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	9.3e+01	+	2.5e−05	+	0.0e+00	·
	(0.0e+00)	(2.4e+01)		(8.2e−06)		(0.0e+00)	
f_2	1.2e+08	3.1e+08	+	2.7e+08	+	1.8e+08	+
	(1.1e+07)	(4.3e+07)		(4.5e+07)		(1.9e+07)	
f_3	4.0e+08	1.1e+09	+	2.4e+10	+	3.3e+08	·
	(1.0e+08)	(3.8e+08)		(4.8e+09)		(1.4e+08)	
f_4	9.0e+04	1.2e+05	+	8.2e+04	−	8.7e+04	·
	(7.8e+03)	(1.1e+04)		(8.2e+03)		(9.3e+03)	
f_5	3.1e−03	5.4e+01	+	4.8e−03	+	0.0e+00	−
	(7.7e−03)	(2.4e+01)		(1.0e−03)		(0.0e+00)	
f_6	4.8e+01	5.3e+01	+	4.7e+01	−	4.8e+01	·
	(2.2e−01)	(1.6e+00)		(8.2e−01)		(1.8e−01)	
f_7	7.5e+01	5.6e+01	−	1.1e+02	+	5.9e+01	−
	(4.7e+00)	(8.2e+00)		(8.8e+00)		(3.4e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.4e−02)	(3.2e−02)		(3.8e−02)		(3.3e−02)	
f_9	6.8e+01	7.2e+01	+	7.1e+01	+	7.0e+01	+
	(1.7e+00)	(1.5e+00)		(1.4e+00)		(1.5e+00)	
f_{10}	2.0e+01	5.0e+01	+	4.8e+02	+	7.4e+00	−
	(2.5e+00)	(1.3e+01)		(1.1e+02)		(1.2e+00)	
f_{11}	1.8e+02	3.7e+01	−	1.7e+02	·	1.7e+02	·
	(9.5e+00)	(4.8e+00)		(1.4e+01)		(7.4e+00)	
f_{12}	3.8e+02	3.6e+02	−	4.3e+02	+	3.6e+02	−
	(1.6e+01)	(1.3e+01)		(2.0e+01)		(1.2e+01)	
f_{13}	3.9e+02	3.6e+02	−	4.3e+02	+	3.6e+02	−
	(1.3e+01)	(9.8e+00)		(2.1e+01)		(1.3e+01)	
f_{14}	8.9e+03	1.2e+02	−	5.4e+03	−	8.4e+03	−
	(2.0e+02)	(3.0e+01)		(4.1e+02)		(2.8e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.8e+02)	(3.5e+02)		(2.8e+02)		(3.6e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.4e+00	·	3.3e+00	·
	(3.3e−01)	(3.3e−01)		(2.1e−01)		(2.9e−01)	
f_{17}	2.3e+02	1.2e+02	−	2.4e+02	+	2.2e+02	·
	(1.0e+01)	(1.1e+01)		(1.5e+01)		(1.1e+01)	
f_{18}	4.1e+02	4.0e+02	·	4.8e+02	+	4.0e+02	−
	(1.2e+01)	(1.3e+01)		(1.6e+01)		(1.2e+01)	
f_{19}	2.0e+01	8.6e+00	−	2.9e+01	+	2.0e+01	·
	(1.2e+00)	(1.3e+00)		(1.8e+00)		(8.2e−01)	
f_{20}	2.3e+01	2.2e+01	−	2.3e+01	−	2.3e+01	−
	(2.4e−01)	(1.8e−01)		(2.2e−01)		(2.2e−01)	
f_{21}	1.1e+03	1.1e+03	·	7.4e+02	·	1.1e+03	+
	(1.7e+02)	(3.4e+02)		(4.5e+02)		(1.5e+02)	
f_{22}	9.2e+03	2.5e+02	−	5.7e+03	−	8.8e+03	−
	(3.3e+02)	(6.1e+01)		(5.8e+02)		(3.8e+02)	
f_{23}	1.5e+04	1.5e+04	·	1.4e+04	−	1.5e+04	·
	(3.9e+02)	(3.9e+02)		(3.8e+02)		(3.6e+02)	
f_{24}	2.8e+02	3.4e+02	+	3.6e+02	+	2.7e+02	−
	(5.8e+00)	(1.3e+01)		(6.2e+00)		(7.1e+00)	
f_{25}	4.0e+02	3.9e+02	−	3.8e+02	−	3.9e+02	−
	(4.1e+00)	(3.8e+00)		(8.8e+00)		(4.7e+00)	
f_{26}	2.2e+02	2.8e+02	+	2.7e+02	+	2.5e+02	+
	(2.7e+00)	(1.6e+01)		(8.8e+01)		(9.6e+00)	
f_{27}	1.8e+03	2.0e+03	+	2.0e+03	+	1.8e+03	·
	(4.6e+01)	(3.9e+01)		(6.0e+01)		(4.4e+01)	
f_{28}	4.0e+02	5.0e+02	+	7.9e+02	+	4.0e+02	−
	(1.7e−08)	(2.4e+01)		(1.1e+03)		(9.2e−05)	
Summary (+/·/−)		12/6/10		16/5/7		4/12/12	

Table 196: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	5.6e+03	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(4.7e+02)		(0.0e+00)		(0.0e+00)	
f_2	5.9e+07	3.8e+08	+	2.0e+08	+	1.7e+08	+
	(8.4e+06)	(4.8e+07)		(3.7e+07)		(3.1e+07)	
f_3	4.6e+07	4.1e+10	+	1.0e+10	+	2.9e+09	+
	(1.0e+08)	(3.3e+09)		(3.5e+09)		(1.5e+09)	
f_4	5.7e+04	1.2e+05	+	7.1e+04	+	6.3e+04	+
	(6.1e+03)	(1.0e+04)		(8.2e+03)		(6.5e+03)	
f_5	1.4e−07	8.2e+02	+	1.3e−07	+	0.0e+00	−
	(5.1e−07)	(6.4e+01)		(6.2e−08)		(0.0e+00)	
f_6	4.8e+01	3.8e+02	+	4.6e+01	−	4.6e+01	−
	(1.0e+00)	(3.0e+01)		(1.0e+00)		(1.0e+00)	
f_7	3.7e+01	1.4e+02	+	9.1e+01	+	5.9e+01	+
	(7.3e+00)	(6.6e+00)		(9.9e+00)		(9.4e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(2.8e−02)	(3.6e−02)		(3.6e−02)		(3.8e−02)	
f_9	6.7e+01	7.2e+01	+	7.1e+01	+	7.0e+01	+
	(1.6e+00)	(1.3e+00)		(1.8e+00)		(1.7e+00)	
f_{10}	5.6e+00	1.6e+03	+	3.3e+01	+	4.7e+00	·
	(3.5e+00)	(1.2e+02)		(1.4e+01)		(2.5e+00)	
f_{11}	1.7e+02	3.3e+02	+	1.4e+02	−	1.9e+02	+
	(1.1e+01)	(1.8e+01)		(1.3e+01)		(8.8e+00)	
f_{12}	3.7e+02	5.0e+02	+	4.0e+02	+	3.7e+02	·
	(1.6e+01)	(1.8e+01)		(1.8e+01)		(1.1e+01)	
f_{13}	3.6e+02	5.0e+02	+	4.0e+02	+	3.7e+02	·
	(1.7e+01)	(2.0e+01)		(2.3e+01)		(1.4e+01)	
f_{14}	8.5e+03	7.6e+03	−	5.3e+03	−	8.4e+03	·
	(3.8e+02)	(4.1e+02)		(5.5e+02)		(3.8e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.8e+02)	(3.5e+02)		(3.7e+02)		(3.9e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.3e+00	·	3.3e+00	·
	(2.5e−01)	(2.8e−01)		(3.1e−01)		(2.9e−01)	
f_{17}	2.3e+02	6.4e+02	+	2.1e+02	−	2.5e+02	+
	(9.8e+00)	(2.8e+01)		(1.3e+01)		(8.1e+00)	
f_{18}	4.1e+02	7.4e+02	+	4.5e+02	+	4.2e+02	+
	(1.4e+01)	(3.3e+01)		(1.5e+01)		(1.5e+01)	
f_{19}	2.0e+01	4.1e+02	+	2.5e+01	+	2.2e+01	+
	(1.1e+00)	(7.4e+01)		(1.2e+00)		(1.0e+00)	
f_{20}	2.2e+01	2.3e+01	+	2.2e+01	·	2.2e+01	·
	(2.1e−01)	(2.7e−01)		(2.6e−01)		(2.0e−01)	
f_{21}	6.7e+02	2.0e+03	+	7.6e+02	+	7.2e+02	+
	(4.4e+02)	(3.0e+02)		(4.3e+02)		(4.4e+02)	
f_{22}	8.3e+03	8.5e+03	·	5.4e+03	−	8.4e+03	·
	(3.8e+02)	(3.9e+02)		(5.7e+02)		(3.6e+02)	
f_{23}	1.4e+04	1.5e+04	+	1.4e+04	·	1.4e+04	·
	(4.1e+02)	(3.9e+02)		(4.1e+02)		(4.4e+02)	
f_{24}	2.4e+02	3.7e+02	+	3.4e+02	+	3.1e+02	+
	(3.1e+01)	(3.0e+00)		(1.3e+01)		(2.2e+01)	
f_{25}	3.5e+02	4.1e+02	+	3.6e+02	+	3.7e+02	+
	(1.7e+01)	(4.2e+00)		(1.8e+01)		(1.2e+01)	
f_{26}	2.1e+02	2.8e+02	+	2.6e+02	+	2.6e+02	+
	(3.2e+00)	(1.4e+01)		(8.8e+01)		(8.3e+01)	
f_{27}	1.5e+03	2.1e+03	+	1.9e+03	+	1.8e+03	+
	(3.0e+02)	(3.8e+01)		(1.2e+02)		(1.1e+02)	
f_{28}	5.2e+02	1.3e+03	+	9.1e+02	+	5.9e+02	+
	(6.1e+01)	(6.1e+01)		(1.2e+03)		(7.6e+02)	
Summary (+/·/−)		23/4/1		17/6/5		15/11/2	

Table 197: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	4.6e−06	6.6e−06	+	4.9e+00	+	1.6e−06	−
	(7.7e−07)	(8.0e−07)		(8.5e−01)		(1.8e−07)	
f_2	3.8e+08	3.9e+08	·	3.5e+08	·	3.2e+08	−
	(3.8e+07)	(6.2e+07)		(4.8e+07)		(4.7e+07)	
f_3	1.9e+10	1.9e+10	·	4.4e+10	+	2.0e+10	+
	(1.9e+09)	(2.3e+09)		(4.4e+09)		(2.0e+09)	
f_4	1.2e+05	1.2e+05	·	9.6e+04	−	1.1e+05	·
	(1.1e+04)	(1.1e+04)		(9.3e+03)		(9.8e+03)	
f_5	1.2e−03	2.0e−03	+	6.5e+00	+	2.9e−04	−
	(1.4e−04)	(1.8e−04)		(9.5e−01)		(2.9e−05)	
f_6	4.7e+01	4.7e+01	+	5.3e+01	+	4.7e+01	−
	(1.2e−01)	(1.2e−01)		(2.4e+00)		(9.5e−02)	
f_7	1.2e+02	1.3e+02	·	1.4e+02	+	1.2e+02	·
	(5.6e+00)	(5.2e+00)		(1.0e+01)		(5.8e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.6e−02)	(3.8e−02)		(3.6e−02)		(3.2e−02)	
f_9	7.2e+01	7.2e+01	·	7.1e+01	·	7.2e+01	·
	(1.6e+00)	(1.7e+00)		(1.6e+00)		(1.2e+00)	
f_{10}	8.0e+02	8.4e+02	·	1.5e+03	+	7.2e+02	−
	(9.5e+01)	(9.1e+01)		(2.0e+02)		(6.4e+01)	
f_{11}	2.2e+02	2.0e+02	−	2.0e+02	−	2.2e+02	·
	(8.5e+00)	(9.5e+00)		(1.5e+01)		(1.0e+01)	
f_{12}	4.2e+02	4.2e+02	·	4.9e+02	+	4.2e+02	·
	(1.5e+01)	(1.5e+01)		(2.1e+01)		(1.4e+01)	
f_{13}	4.2e+02	4.2e+02	·	4.9e+02	+	4.2e+02	·
	(1.4e+01)	(1.3e+01)		(1.6e+01)		(1.3e+01)	
f_{14}	8.6e+03	7.6e+03	−	5.7e+03	−	8.8e+03	·
	(2.6e+02)	(3.8e+02)		(4.5e+02)		(2.9e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.4e+02)	(4.4e+02)		(3.4e+02)		(3.5e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.3e+00	·	3.4e+00	·
	(3.5e−01)	(2.8e−01)		(2.4e−01)		(2.9e−01)	
f_{17}	2.7e+02	2.6e+02	−	3.1e+02	+	2.8e+02	·
	(1.0e+01)	(9.5e+00)		(1.8e+01)		(1.2e+01)	
f_{18}	4.7e+02	4.7e+02	·	5.5e+02	+	4.7e+02	·
	(1.5e+01)	(1.1e+01)		(2.3e+01)		(1.2e+01)	
f_{19}	2.7e+01	2.7e+01	·	4.2e+01	+	2.6e+01	·
	(8.5e−01)	(1.1e+00)		(2.8e+00)		(1.1e+00)	
f_{20}	2.3e+01	2.3e+01	·	2.3e+01	·	2.3e+01	+
	(2.2e−01)	(2.3e−01)		(2.3e−01)		(2.1e−01)	
f_{21}	7.5e+02	5.6e+02	−	8.0e+02	·	1.2e+03	+
	(2.1e+02)	(1.6e+02)		(5.4e+02)		(1.4e+02)	
f_{22}	9.3e+03	8.7e+03	−	6.0e+03	−	9.6e+03	+
	(3.8e+02)	(4.4e+02)		(5.7e+02)		(2.5e+02)	
f_{23}	1.5e+04	1.5e+04	·	1.4e+04	−	1.5e+04	·
	(3.8e+02)	(3.9e+02)		(4.1e+02)		(4.4e+02)	
f_{24}	3.6e+02	3.7e+02	+	3.7e+02	+	3.6e+02	−
	(3.7e+00)	(3.7e+00)		(4.7e+00)		(4.1e+00)	
f_{25}	4.0e+02	4.0e+02	·	4.0e+02	·	4.1e+02	+
	(3.4e+00)	(4.4e+00)		(6.9e+00)		(4.7e+00)	
f_{26}	2.7e+02	2.8e+02	·	2.5e+02	−	2.7e+02	−
	(1.2e+01)	(1.4e+01)		(3.4e+01)		(1.1e+01)	
f_{27}	2.1e+03	2.1e+03	·	2.1e+03	·	2.0e+03	−
	(3.7e+01)	(4.1e+01)		(5.7e+01)		(4.9e+01)	
f_{28}	4.0e+02	4.0e+02	+	4.9e+02	+	4.0e+02	·
	(3.0e−03)	(8.0e−03)		(4.8e+02)		(8.1e+00)	
Summary (+/·/−)		5/18/5		13/9/6		5/15/8	

Table 198: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.3}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	0.0e+00	·	4.4e−04	+	5.5e−03	+
	(0.0e+00)	(0.0e+00)		(1.4e−04)		(2.1e−03)	
f_2	8.5e+07	3.2e+08	+	2.8e+08	+	2.8e+08	+
	(1.4e+07)	(4.6e+07)		(4.9e+07)		(4.9e+07)	
f_3	9.9e+05	1.7e+08	+	2.8e+10	+	3.3e+10	+
	(2.1e+06)	(2.5e+08)		(5.1e+09)		(5.0e+09)	
f_4	6.7e+04	1.2e+05	+	8.4e+04	+	8.4e+04	+
	(7.0e+03)	(1.1e+04)		(8.5e+03)		(9.1e+03)	
f_5	3.0e−06	0.0e+00	−	2.6e−02	+	1.2e−01	+
	(6.1e−06)	(0.0e+00)		(6.1e−03)		(2.4e−02)	
f_6	4.7e+01	4.8e+01	+	4.7e+01	·	4.7e+01	·
	(6.8e−01)	(2.1e−01)		(8.4e−01)		(8.3e−01)	
f_7	2.6e+01	6.0e+01	+	1.2e+02	+	1.3e+02	+
	(4.6e+00)	(4.9e+00)		(1.0e+01)		(9.7e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.3e−02)	(3.9e−02)		(3.7e−02)		(3.5e−02)	
f_9	6.7e+01	7.2e+01	+	7.1e+01	+	7.1e+01	+
	(1.6e+00)	(1.3e+00)		(1.6e+00)		(1.8e+00)	
f_{10}	6.0e+00	5.1e+00	·	6.4e+02	+	9.4e+02	+
	(3.3e+00)	(1.3e+00)		(1.0e+02)		(1.7e+02)	
f_{11}	1.7e+02	7.7e+01	−	1.7e+02	·	2.6e+02	+
	(9.2e+00)	(6.4e+00)		(1.4e+01)		(1.2e+01)	
f_{12}	3.6e+02	3.7e+02	·	4.5e+02	+	4.6e+02	+
	(1.3e+01)	(9.7e+00)		(1.9e+01)		(1.7e+01)	
f_{13}	3.6e+02	3.7e+02	·	4.5e+02	+	4.6e+02	+
	(1.3e+01)	(1.3e+01)		(1.5e+01)		(1.8e+01)	
f_{14}	8.6e+03	6.1e+03	−	5.5e+03	−	8.8e+03	+
	(2.6e+02)	(3.8e+02)		(5.0e+02)		(3.1e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.3e+02)	(3.9e+02)		(3.8e+02)		(4.2e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.3e+00	·	3.3e+00	·
	(2.6e−01)	(3.2e−01)		(2.7e−01)		(2.9e−01)	
f_{17}	2.2e+02	2.1e+02	·	2.5e+02	+	3.4e+02	+
	(1.0e+01)	(8.8e+00)		(1.6e+01)		(1.3e+01)	
f_{18}	4.0e+02	4.1e+02	·	5.0e+02	+	5.1e+02	+
	(1.1e+01)	(1.2e+01)		(1.7e+01)		(1.7e+01)	
f_{19}	2.0e+01	2.1e+01	·	3.0e+01	+	3.2e+01	+
	(1.1e+00)	(8.6e−01)		(1.6e+00)		(1.8e+00)	
f_{20}	2.2e+01	2.3e+01	+	2.3e+01	+	2.3e+01	+
	(2.8e−01)	(1.8e−01)		(2.0e−01)		(2.4e−01)	
f_{21}	8.1e+02	6.3e+02	·	7.9e+02	·	7.0e+02	·
	(3.9e+02)	(4.0e+02)		(4.2e+02)		(4.6e+02)	
f_{22}	8.3e+03	7.3e+03	−	5.8e+03	−	9.0e+03	+
	(3.7e+02)	(6.0e+02)		(5.1e+02)		(2.5e+02)	
f_{23}	1.4e+04	1.5e+04	·	1.4e+04	·	1.4e+04	·
	(3.9e+02)	(3.3e+02)		(3.7e+02)		(4.1e+02)	
f_{24}	2.1e+02	3.5e+02	+	3.6e+02	+	3.6e+02	+
	(6.5e+00)	(6.6e+00)		(7.8e+00)		(6.2e+00)	
f_{25}	3.7e+02	3.9e+02	+	3.9e+02	+	3.9e+02	+
	(1.1e+01)	(3.4e+00)		(1.0e+01)		(7.9e+00)	
f_{26}	2.1e+02	2.8e+02	+	2.5e+02	+	2.7e+02	+
	(2.8e+00)	(1.5e+01)		(5.6e+01)		(7.8e+01)	
f_{27}	1.5e+03	2.0e+03	+	2.0e+03	+	2.0e+03	+
	(1.9e+02)	(3.9e+01)		(5.2e+01)		(6.1e+01)	
f_{28}	4.0e+02	4.0e+02	+	7.9e+02	+	6.0e+02	+
	(1.9e−12)	(7.0e−09)		(1.1e+03)		(8.0e+02)	
Summary (+/·/−)		12/12/4		19/7/2		22/6/0	

Table 199: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.0e−02	1.0e−02	·	8.1e+01	+	1.7e−03	−
	(1.7e−03)	(1.4e−03)		(1.9e+01)		(2.1e−04)	
f_2	4.7e+08	4.9e+08	·	4.1e+08	−	4.1e+08	−
	(5.9e+07)	(6.6e+07)		(7.2e+07)		(5.4e+07)	
f_3	2.0e+10	2.0e+10	·	5.6e+10	+	2.2e+10	+
	(2.0e+09)	(2.2e+09)		(7.0e+09)		(1.8e+09)	
f_4	1.2e+05	1.2e+05	·	8.9e+04	−	1.1e+05	−
	(9.2e+03)	(9.9e+03)		(1.1e+04)		(7.1e+03)	
f_5	2.1e−01	2.1e−01	·	3.1e+01	+	3.5e−02	−
	(2.6e−02)	(2.4e−02)		(4.1e+00)		(3.4e−03)	
f_6	4.7e+01	4.7e+01	·	6.8e+01	+	4.7e+01	−
	(1.4e−01)	(1.4e−01)		(8.5e+00)		(1.3e−01)	
f_7	1.2e+02	1.2e+02	·	1.5e+02	+	1.2e+02	·
	(6.2e+00)	(6.3e+00)		(1.1e+01)		(5.1e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(2.8e−02)	(3.7e−02)		(3.8e−02)		(3.6e−02)	
f_9	7.3e+01	7.3e+01	·	7.2e+01	·	7.3e+01	·
	(1.7e+00)	(1.6e+00)		(1.5e+00)		(1.5e+00)	
f_{10}	1.0e+03	1.0e+03	·	1.4e+03	+	1.1e+03	+
	(1.1e+02)	(1.3e+02)		(3.4e+02)		(9.8e+01)	
f_{11}	2.6e+02	2.7e+02	·	1.5e+02	−	3.0e+02	+
	(1.3e+01)	(1.3e+01)		(2.0e+01)		(1.5e+01)	
f_{12}	4.3e+02	4.2e+02	·	5.0e+02	+	4.3e+02	·
	(1.2e+01)	(1.7e+01)		(2.0e+01)		(1.5e+01)	
f_{13}	4.3e+02	4.3e+02	·	5.1e+02	+	4.3e+02	·
	(1.4e+01)	(1.7e+01)		(2.5e+01)		(1.4e+01)	
f_{14}	9.4e+03	9.2e+03	·	3.5e+03	−	1.1e+04	+
	(3.8e+02)	(4.7e+02)		(5.3e+02)		(3.4e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.1e+02)	(3.9e+02)		(3.7e+02)		(3.5e+02)	
f_{16}	3.3e+00	3.4e+00	·	3.3e+00	·	3.3e+00	·
	(3.3e−01)	(2.5e−01)		(3.1e−01)		(2.9e−01)	
f_{17}	3.4e+02	3.3e+02	·	3.0e+02	−	3.7e+02	+
	(1.6e+01)	(1.7e+01)		(3.2e+01)		(1.2e+01)	
f_{18}	4.8e+02	4.8e+02	·	5.8e+02	+	4.8e+02	·
	(1.7e+01)	(1.4e+01)		(2.5e+01)		(1.6e+01)	
f_{19}	3.4e+01	3.4e+01	·	5.4e+01	+	3.3e+01	·
	(1.2e+00)	(1.2e+00)		(8.0e+00)		(1.4e+00)	
f_{20}	2.3e+01	2.3e+01	·	2.3e+01	·	2.3e+01	·
	(1.9e−01)	(1.7e−01)		(2.6e−01)		(2.0e−01)	
f_{21}	3.3e+02	3.4e+02	·	1.2e+03	+	1.2e+03	+
	(2.5e+02)	(2.4e+02)		(5.8e+02)		(2.3e+02)	
f_{22}	9.7e+03	9.9e+03	·	3.6e+03	−	1.1e+04	+
	(4.7e+02)	(3.5e+02)		(6.8e+02)		(3.5e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.5e+04	·
	(3.9e+02)	(4.5e+02)		(3.2e+02)		(4.0e+02)	
f_{24}	3.7e+02	3.7e+02	·	3.7e+02	+	3.5e+02	−
	(3.7e+00)	(4.0e+00)		(6.8e+00)		(4.6e+00)	
f_{25}	4.1e+02	4.0e+02	·	4.0e+02	·	4.1e+02	+
	(4.5e+00)	(4.2e+00)		(1.2e+01)		(3.9e+00)	
f_{26}	4.0e+02	3.8e+02	·	4.2e+02	·	3.7e+02	·
	(4.2e+01)	(5.2e+01)		(1.0e+02)		(3.9e+01)	
f_{27}	2.1e+03	2.1e+03	·	2.1e+03	·	2.1e+03	−
	(4.1e+01)	(3.5e+01)		(5.0e+01)		(3.8e+01)	
f_{28}	4.0e+02	4.0e+02	·	6.7e+02	+	4.0e+02	−
	(7.0e−02)	(6.1e−02)		(8.2e+02)		(3.0e−02)	
Summary (+/·/−)		0/28/0		13/9/6		8/12/8	

Table 200: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	7.9e+02	5.1e+02	−	1.4e+03	+	5.8e+02	−
	(6.7e+01)	(5.7e+01)		(3.3e+02)		(4.5e+01)	
f_2	5.6e+08	5.5e+08	·	5.2e+08	·	5.3e+08	·
	(7.3e+07)	(7.2e+07)		(7.0e+07)		(7.5e+07)	
f_3	6.1e+10	5.8e+10	·	7.4e+10	+	6.1e+10	·
	(4.8e+09)	(5.2e+09)		(1.0e+10)		(5.6e+09)	
f_4	1.2e+05	1.3e+05	·	1.0e+05	−	1.2e+05	·
	(9.0e+03)	(8.2e+03)		(1.2e+04)		(9.2e+03)	
f_5	9.3e+01	7.4e+01	−	1.9e+02	+	6.7e+01	−
	(5.1e+00)	(6.0e+00)		(2.1e+01)		(3.5e+00)	
f_6	2.7e+02	1.8e+02	−	2.6e+02	·	2.8e+02	·
	(2.3e+01)	(1.6e+01)		(5.0e+01)		(1.9e+01)	
f_7	1.6e+02	1.6e+02	·	1.8e+02	+	1.6e+02	·
	(7.0e+00)	(7.1e+00)		(1.2e+01)		(7.7e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.4e−02)	(3.8e−02)		(4.0e−02)		(4.0e−02)	
f_9	7.3e+01	7.3e+01	·	7.3e+01	·	7.2e+01	·
	(1.4e+00)	(1.3e+00)		(1.4e+00)		(1.7e+00)	
f_{10}	3.0e+03	2.7e+03	−	2.4e+03	−	2.9e+03	·
	(2.6e+02)	(3.0e+02)		(3.7e+02)		(2.7e+02)	
f_{11}	3.8e+02	3.4e+02	−	1.6e+02	−	3.8e+02	·
	(1.6e+01)	(1.6e+01)		(2.0e+01)		(1.3e+01)	
f_{12}	5.5e+02	5.2e+02	−	5.7e+02	·	5.4e+02	·
	(2.0e+01)	(2.5e+01)		(3.1e+01)		(2.0e+01)	
f_{13}	5.4e+02	5.2e+02	−	5.6e+02	·	5.4e+02	·
	(1.8e+01)	(2.3e+01)		(3.2e+01)		(2.0e+01)	
f_{14}	1.1e+04	9.6e+03	−	2.4e+03	−	1.1e+04	·
	(3.3e+02)	(4.3e+02)		(4.5e+02)		(3.0e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.4e+02)	(4.0e+02)		(3.9e+02)		(3.5e+02)	
f_{16}	3.3e+00	3.4e+00	·	3.3e+00	·	3.3e+00	·
	(2.9e−01)	(2.3e−01)		(2.7e−01)		(3.5e−01)	
f_{17}	5.5e+02	4.9e+02	−	4.0e+02	−	5.4e+02	·
	(1.8e+01)	(1.7e+01)		(4.6e+01)		(1.8e+01)	
f_{18}	6.5e+02	6.0e+02	−	6.7e+02	+	6.4e+02	·
	(2.1e+01)	(2.4e+01)		(3.0e+01)		(2.3e+01)	
f_{19}	2.3e+02	1.1e+02	−	2.7e+02	·	1.6e+02	−
	(3.8e+01)	(1.8e+01)		(1.1e+02)		(2.6e+01)	
f_{20}	2.3e+01	2.3e+01	·	2.3e+01	·	2.3e+01	·
	(1.8e−01)	(1.6e−01)		(1.9e−01)		(2.3e−01)	
f_{21}	1.3e+03	9.7e+02	·	1.7e+03	·	2.0e+03	+
	(3.9e+02)	(3.0e+02)		(8.5e+02)		(2.3e+02)	
f_{22}	1.1e+04	1.0e+04	−	2.8e+03	−	1.2e+04	+
	(3.5e+02)	(5.1e+02)		(4.9e+02)		(3.3e+02)	
f_{23}	1.5e+04	1.5e+04	·	1.4e+04	·	1.5e+04	·
	(3.9e+02)	(2.9e+02)		(4.5e+02)		(3.3e+02)	
f_{24}	3.8e+02	3.8e+02	·	3.8e+02	·	3.8e+02	·
	(3.4e+00)	(4.6e+00)		(5.7e+00)		(4.3e+00)	
f_{25}	4.2e+02	4.2e+02	·	4.1e+02	·	4.2e+02	+
	(4.4e+00)	(4.0e+00)		(5.9e+00)		(4.3e+00)	
f_{26}	3.9e+02	3.8e+02	·	3.4e+02	·	3.8e+02	·
	(3.7e+01)	(4.0e+01)		(1.0e+02)		(3.1e+01)	
f_{27}	2.2e+03	2.1e+03	·	2.2e+03	·	2.2e+03	·
	(3.0e+01)	(4.0e+01)		(4.3e+01)		(4.4e+01)	
f_{28}	6.3e+02	5.8e+02	−	7.9e+02	+	6.1e+02	−
	(1.2e+01)	(1.3e+01)		(4.8e+02)		(1.3e+01)	
Summary (+/·/−)		0/15/13		6/16/6		3/21/4	

Table 201: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	2.4e+04	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(2.0e+03)		(0.0e+00)		(0.0e+00)	
f_2	3.3e+07	6.3e+08	+	3.1e+07	·	5.9e+07	+
	(1.2e+07)	(8.5e+07)		(1.3e+07)		(2.1e+07)	
f_3	1.0e+09	1.1e+11	+	1.1e+09	·	2.7e+09	+
	(1.5e+09)	(9.6e+09)		(1.1e+09)		(2.6e+09)	
f_4	3.7e+04	1.3e+05	+	3.6e+04	·	3.8e+04	·
	(6.1e+03)	(9.2e+03)		(3.8e+03)		(4.7e+03)	
f_5	0.0e+00	4.6e+03	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(4.2e+02)		(0.0e+00)		(0.0e+00)	
f_6	5.4e+01	1.7e+03	+	5.2e+01	·	5.0e+01	·
	(1.9e+01)	(1.5e+02)		(1.6e+01)		(1.2e+01)	
f_7	7.0e+01	2.1e+02	+	7.1e+01	·	6.5e+01	·
	(2.3e+01)	(1.2e+01)		(2.3e+01)		(2.4e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.6e−02)	(4.0e−02)		(3.5e−02)		(4.7e−02)	
f_9	3.5e+01	7.2e+01	+	4.0e+01	·	6.1e+01	+
	(1.7e+01)	(1.6e+00)		(1.8e+01)		(6.7e+00)	
f_{10}	3.9e−01	4.7e+03	+	2.7e−01	·	1.7e+00	+
	(1.4e+00)	(4.8e+02)		(8.3e−01)		(8.3e−01)	
f_{11}	6.9e+01	6.7e+02	+	6.5e+01	·	1.1e+02	·
	(1.5e+01)	(3.3e+01)		(1.6e+01)		(7.0e+01)	
f_{12}	3.8e+02	7.7e+02	+	3.8e+02	·	3.8e+02	·
	(2.4e+01)	(2.8e+01)		(2.3e+01)		(2.1e+01)	
f_{13}	3.8e+02	7.7e+02	+	3.9e+02	·	3.8e+02	·
	(2.3e+01)	(2.4e+01)		(2.5e+01)		(2.5e+01)	
f_{14}	1.7e+03	9.6e+03	+	1.5e+03	·	1.0e+04	+
	(3.8e+02)	(3.8e+02)		(3.8e+02)		(4.5e+02)	
f_{15}	1.4e+04	1.4e+04	+	1.4e+04	·	1.4e+04	·
	(4.1e+02)	(3.5e+02)		(4.0e+02)		(3.7e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.3e+00	·	3.3e+00	·
	(2.7e−01)	(2.8e−01)		(3.6e−01)		(2.5e−01)	
f_{17}	1.5e+02	1.5e+03	+	1.6e+02	·	3.2e+02	+
	(1.9e+01)	(8.9e+01)		(2.2e+01)		(1.8e+01)	
f_{18}	4.2e+02	1.5e+03	+	4.2e+02	·	4.1e+02	·
	(1.8e+01)	(8.3e+01)		(2.2e+01)		(2.3e+01)	
f_{19}	2.1e+01	3.4e+04	+	2.2e+01	·	2.5e+01	+
	(3.6e+00)	(9.6e+03)		(3.1e+00)		(2.2e+00)	
f_{20}	2.2e+01	2.3e+01	+	2.2e+01	·	2.2e+01	·
	(3.6e−01)	(2.0e−01)		(4.2e−01)		(3.5e−01)	
f_{21}	7.8e+02	3.9e+03	+	7.4e+02	·	7.1e+02	·
	(4.1e+02)	(3.2e+02)		(4.1e+02)		(4.3e+02)	
f_{22}	1.9e+03	1.1e+04	+	1.9e+03	·	9.8e+03	+
	(4.5e+02)	(3.7e+02)		(5.6e+02)		(7.3e+02)	
f_{23}	1.4e+04	1.5e+04	+	1.4e+04	·	1.4e+04	·
	(4.9e+02)	(3.7e+02)		(4.6e+02)		(4.8e+02)	
f_{24}	2.7e+02	4.0e+02	+	2.7e+02	·	2.7e+02	·
	(9.2e+00)	(5.9e+00)		(1.2e+01)		(1.4e+01)	
f_{25}	3.0e+02	4.3e+02	+	3.0e+02	·	3.0e+02	·
	(1.1e+01)	(6.9e+00)		(1.0e+01)		(1.3e+01)	
f_{26}	3.3e+02	3.9e+02	+	3.3e+02	·	3.7e+02	+
	(5.8e+01)	(3.9e+01)		(6.7e+01)		(7.9e+01)	
f_{27}	9.7e+02	2.2e+03	+	9.2e+02	·	1.1e+03	+
	(9.9e+01)	(3.7e+01)		(9.2e+01)		(2.2e+02)	
f_{28}	1.2e+03	3.7e+03	+	1.4e+03	·	1.1e+03	+
	(1.3e+03)	(2.0e+02)		(1.4e+03)		(1.3e+03)	
Summary (+/·/−)		26/2/0		0/28/0		11/17/0	

Table 202: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.3e−04	2.0e+02	+	2.1e−05	−	1.9e−04	+
	(5.9e−05)	(4.8e+01)		(9.3e−06)		(9.6e−05)	
f_2	2.6e+08	2.8e+08	·	2.4e+08	·	2.6e+08	·
	(5.8e+07)	(4.3e+07)		(5.8e+07)		(5.1e+07)	
f_3	2.7e+10	2.8e+09	−	2.2e+10	−	2.8e+10	·
	(5.1e+09)	(1.2e+09)		(5.2e+09)		(5.2e+09)	
f_4	6.8e+04	1.1e+05	+	7.0e+04	·	6.9e+04	·
	(8.9e+03)	(1.1e+04)		(8.6e+03)		(8.7e+03)	
f_5	1.4e−02	1.1e+02	+	4.2e−03	−	1.6e−02	·
	(5.9e−03)	(3.9e+01)		(1.6e−03)		(7.6e−03)	
f_6	4.6e+01	5.7e+01	+	4.7e+01	·	4.6e+01	·
	(8.6e−01)	(2.8e+00)		(1.4e+00)		(9.0e−01)	
f_7	1.2e+02	3.6e+01	−	1.1e+02	−	1.2e+02	·
	(1.1e+01)	(7.3e+00)		(1.2e+01)		(1.2e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.4e−02)	(3.8e−02)		(3.5e−02)		(3.9e−02)	
f_9	7.2e+01	7.3e+01	·	7.1e+01	·	7.2e+01	·
	(1.8e+00)	(1.0e+00)		(2.4e+00)		(1.5e+00)	
f_{10}	3.9e+02	8.5e+01	−	1.3e+02	−	5.2e+02	+
	(1.0e+02)	(2.6e+01)		(4.4e+01)		(1.5e+02)	
f_{11}	3.2e+02	5.3e+01	−	1.0e+02	−	3.2e+02	·
	(1.4e+01)	(7.4e+00)		(2.5e+01)		(1.4e+01)	
f_{12}	4.4e+02	3.4e+02	−	4.3e+02	·	4.4e+02	·
	(1.8e+01)	(1.3e+01)		(1.5e+01)		(1.8e+01)	
f_{13}	4.4e+02	3.4e+02	−	4.3e+02	·	4.4e+02	·
	(1.7e+01)	(1.2e+01)		(2.2e+01)		(1.8e+01)	
f_{14}	1.1e+04	1.9e+02	−	3.0e+03	−	1.1e+04	·
	(4.1e+02)	(5.4e+01)		(7.8e+02)		(3.6e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.5e+02)	(4.0e+02)		(3.7e+02)		(3.7e+02)	
f_{16}	3.4e+00	3.3e+00	·	3.3e+00	·	3.3e+00	·
	(2.8e−01)	(2.6e−01)		(3.5e−01)		(3.2e−01)	
f_{17}	3.9e+02	1.5e+02	−	2.0e+02	−	4.0e+02	·
	(1.6e+01)	(1.5e+01)		(1.6e+01)		(1.8e+01)	
f_{18}	4.9e+02	3.8e+02	−	4.8e+02	−	5.0e+02	·
	(1.8e+01)	(1.3e+01)		(2.1e+01)		(1.6e+01)	
f_{19}	3.4e+01	1.5e+01	−	3.1e+01	−	3.5e+01	·
	(1.7e+00)	(2.7e+00)		(2.2e+00)		(1.8e+00)	
f_{20}	2.3e+01	2.2e+01	−	2.3e+01	·	2.3e+01	·
	(1.7e−01)	(1.5e−01)		(2.7e−01)		(2.4e−01)	
f_{21}	7.6e+02	9.6e+02	·	7.2e+02	−	9.2e+02	+
	(4.4e+02)	(4.2e+02)		(4.3e+02)		(3.3e+02)	
f_{22}	1.1e+04	3.6e+02	−	3.1e+03	−	1.1e+04	·
	(4.9e+02)	(7.8e+01)		(7.3e+02)		(3.8e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(4.4e+02)	(3.8e+02)		(4.7e+02)		(3.7e+02)	
f_{24}	3.5e+02	2.7e+02	−	3.4e+02	·	3.6e+02	·
	(1.3e+01)	(8.5e+00)		(1.5e+01)		(1.1e+01)	
f_{25}	3.5e+02	3.4e+02	·	3.4e+02	·	3.6e+02	·
	(2.1e+01)	(2.4e+01)		(2.0e+01)		(1.6e+01)	
f_{26}	4.4e+02	3.5e+02	−	4.1e+02	·	4.2e+02	·
	(8.7e+01)	(4.3e+01)		(1.1e+02)		(1.0e+02)	
f_{27}	2.0e+03	1.7e+03	−	1.9e+03	·	2.0e+03	·
	(1.0e+02)	(3.4e+02)		(1.2e+02)		(8.9e+01)	
f_{28}	9.9e+02	5.6e+02	+	9.8e+02	−	9.2e+02	·
	(1.3e+03)	(3.8e+01)		(1.3e+03)		(1.2e+03)	
Summary (+/·/−)		5/8/15		0/15/13		3/25/0	

Table 203: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	1.9e+02	+	1.9e−05	+	0.0e+00	·
	(0.0e+00)	(5.2e+01)		(9.1e−06)		(0.0e+00)	
f_2	8.9e+07	2.7e+08	+	2.6e+08	+	1.4e+08	+
	(9.6e+06)	(4.5e+07)		(5.9e+07)		(1.7e+07)	
f_3	1.2e+06	2.7e+09	+	2.5e+10	+	7.5e+05	·
	(1.0e+06)	(1.2e+09)		(5.4e+09)		(6.8e+05)	
f_4	7.7e+04	1.1e+05	+	7.0e+04	−	7.7e+04	·
	(6.3e+03)	(1.0e+04)		(9.5e+03)		(7.3e+03)	
f_5	2.9e+00	9.6e+01	+	4.5e−03	−	3.5e−05	−
	(2.9e+00)	(3.5e+01)		(1.7e−03)		(1.6e−04)	
f_6	4.8e+01	5.8e+01	+	4.6e+01	−	4.8e+01	·
	(3.7e−01)	(3.4e+00)		(9.0e−01)		(2.8e−01)	
f_7	2.7e+01	3.7e+01	+	1.1e+02	+	1.4e+01	−
	(3.1e+00)	(6.1e+00)		(1.1e+01)		(2.8e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.5e−02)	(3.5e−02)		(4.7e−02)		(3.3e−02)	
f_9	7.1e+01	7.2e+01	+	7.2e+01	+	7.2e+01	+
	(1.6e+00)	(1.7e+00)		(1.6e+00)		(1.9e+00)	
f_{10}	2.4e+01	8.7e+01	+	1.4e+02	+	1.0e+01	−
	(3.9e+00)	(2.2e+01)		(5.2e+01)		(1.8e+00)	
f_{11}	2.4e+02	5.3e+01	−	1.0e+02	−	2.3e+02	·
	(1.0e+01)	(7.3e+00)		(2.2e+01)		(9.1e+00)	
f_{12}	3.6e+02	3.4e+02	−	4.3e+02	+	3.4e+02	−
	(1.2e+01)	(1.1e+01)		(2.0e+01)		(1.1e+01)	
f_{13}	3.6e+02	3.4e+02	−	4.3e+02	+	3.4e+02	−
	(1.3e+01)	(1.4e+01)		(1.7e+01)		(1.2e+01)	
f_{14}	1.1e+04	1.9e+02	−	3.0e+03	−	1.0e+04	−
	(3.6e+02)	(5.4e+01)		(6.9e+02)		(3.8e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.3e+02)	(3.3e+02)		(3.3e+02)		(3.3e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.4e+00	·	3.3e+00	·
	(2.7e−01)	(2.5e−01)		(2.7e−01)		(2.9e−01)	
f_{17}	2.8e+02	1.4e+02	−	2.0e+02	−	2.8e+02	·
	(1.0e+01)	(1.2e+01)		(1.9e+01)		(1.0e+01)	
f_{18}	3.9e+02	3.8e+02	−	4.8e+02	+	3.8e+02	·
	(9.4e+00)	(1.1e+01)		(1.9e+01)		(1.0e+01)	
f_{19}	2.5e+01	1.5e+01	−	3.0e+01	+	2.4e+01	−
	(1.6e+00)	(3.0e+00)		(2.4e+00)		(1.1e+00)	
f_{20}	2.2e+01	2.2e+01	·	2.2e+01	+	2.2e+01	−
	(2.2e−01)	(2.0e−01)		(2.4e−01)		(2.2e−01)	
f_{21}	1.0e+03	9.7e+02	·	7.9e+02	·	1.1e+03	·
	(2.4e+02)	(4.4e+02)		(4.3e+02)		(1.4e+02)	
f_{22}	1.1e+04	3.9e+02	−	3.0e+03	−	1.0e+04	−
	(4.0e+02)	(1.0e+02)		(8.3e+02)		(3.1e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	−	1.4e+04	·
	(3.2e+02)	(3.4e+02)		(3.8e+02)		(3.8e+02)	
f_{24}	2.1e+02	2.7e+02	+	3.4e+02	+	2.0e+02	−
	(2.3e+00)	(8.4e+00)		(2.1e+01)		(6.5e−01)	
f_{25}	3.9e+02	3.3e+02	−	3.5e+02	−	3.3e+02	−
	(7.9e+00)	(2.2e+01)		(2.2e+01)		(2.9e+01)	
f_{26}	2.1e+02	3.5e+02	+	4.1e+02	+	3.5e+02	+
	(3.1e+00)	(4.6e+01)		(1.1e+02)		(2.2e+01)	
f_{27}	7.1e+02	1.8e+03	+	1.9e+03	+	3.9e+02	−
	(1.1e+02)	(3.0e+02)		(1.6e+02)		(6.5e+01)	
f_{28}	4.0e+02	5.6e+02	+	5.3e+02	+	4.0e+02	−
	(3.0e−11)	(3.8e+01)		(6.5e+02)		(1.9e−13)	
Summary (+/·/−)		13/6/9		15/4/9		3/12/13	

Table 204: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	1.1e+04	+	0.0e+00	·	0.0e+00	·
	(0.0e+00)	(9.9e+02)		(0.0e+00)		(0.0e+00)	
f_2	1.3e+07	4.8e+08	+	1.3e+08	+	1.1e+08	+
	(3.7e+06)	(6.3e+07)		(3.7e+07)		(2.2e+07)	
f_3	2.6e+07	6.2e+10	+	5.5e+09	+	8.1e+08	+
	(3.8e+07)	(4.9e+09)		(4.7e+09)		(1.4e+09)	
f_4	3.3e+04	1.2e+05	+	5.5e+04	+	4.5e+04	+
	(5.4e+03)	(9.2e+03)		(7.0e+03)		(6.2e+03)	
f_5	6.2e−01	2.0e+03	+	0.0e+00	−	0.0e+00	−
	(1.3e+00)	(1.9e+02)		(0.0e+00)		(0.0e+00)	
f_6	5.0e+01	7.0e+02	+	4.6e+01	−	4.6e+01	−
	(1.1e+01)	(6.7e+01)		(1.0e+00)		(1.1e+00)	
f_7	2.5e+01	1.6e+02	+	7.7e+01	+	4.3e+01	+
	(1.2e+01)	(7.6e+00)		(1.4e+01)		(1.6e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.7e−02)	(3.4e−02)		(3.5e−02)		(3.8e−02)	
f_9	6.5e+01	7.3e+01	+	6.8e+01	·	7.0e+01	+
	(6.7e+00)	(1.5e+00)		(5.4e+00)		(1.9e+00)	
f_{10}	2.4e+01	2.7e+03	+	1.2e+00	−	1.0e+00	−
	(1.2e+01)	(2.2e+02)		(1.7e−01)		(3.8e−01)	
f_{11}	2.4e+02	4.5e+02	+	5.1e+01	−	2.6e+02	+
	(1.5e+01)	(2.3e+01)		(1.0e+01)		(1.1e+01)	
f_{12}	3.6e+02	5.8e+02	+	3.9e+02	+	3.6e+02	·
	(1.7e+01)	(2.0e+01)		(1.8e+01)		(1.7e+01)	
f_{13}	3.6e+02	5.9e+02	+	4.0e+02	+	3.7e+02	·
	(1.9e+01)	(2.3e+01)		(1.6e+01)		(1.8e+01)	
f_{14}	1.0e+04	9.3e+03	−	1.6e+03	−	1.1e+04	·
	(4.4e+02)	(4.8e+02)		(6.5e+02)		(3.4e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.8e+02)	(3.8e+02)		(4.0e+02)		(3.6e+02)	
f_{16}	3.4e+00	3.3e+00	·	3.3e+00	·	3.3e+00	·
	(3.1e−01)	(3.0e−01)		(3.2e−01)		(2.4e−01)	
f_{17}	2.9e+02	9.1e+02	+	1.7e+02	−	3.1e+02	+
	(1.3e+01)	(4.4e+01)		(1.8e+01)		(1.1e+01)	
f_{18}	4.0e+02	9.8e+02	+	4.4e+02	+	4.2e+02	+
	(1.5e+01)	(4.4e+01)		(2.1e+01)		(1.2e+01)	
f_{19}	2.4e+01	3.0e+03	+	2.6e+01	+	2.6e+01	+
	(1.7e+00)	(7.4e+02)		(1.7e+00)		(1.2e+00)	
f_{20}	2.2e+01	2.3e+01	+	2.2e+01	+	2.2e+01	·
	(3.0e−01)	(2.3e−01)		(3.0e−01)		(2.9e−01)	
f_{21}	8.1e+02	2.3e+03	+	8.4e+02	·	8.0e+02	·
	(4.1e+02)	(2.5e+02)		(4.1e+02)		(4.2e+02)	
f_{22}	1.0e+04	9.8e+03	−	2.1e+03	−	1.0e+04	·
	(5.6e+02)	(4.7e+02)		(7.2e+02)		(3.7e+02)	
f_{23}	1.4e+04	1.4e+04	+	1.4e+04	·	1.4e+04	·
	(4.8e+02)	(3.4e+02)		(4.5e+02)		(4.3e+02)	
f_{24}	2.4e+02	3.8e+02	+	2.8e+02	+	2.6e+02	+
	(1.5e+01)	(4.0e+00)		(2.0e+01)		(2.4e+01)	
f_{25}	2.9e+02	4.2e+02	+	3.0e+02	·	3.0e+02	·
	(8.6e+00)	(4.1e+00)		(1.3e+01)		(1.7e+01)	
f_{26}	2.3e+02	4.0e+02	+	4.0e+02	+	4.0e+02	+
	(5.8e+01)	(5.0e+01)		(7.9e+01)		(6.9e+01)	
f_{27}	7.8e+02	2.1e+03	+	1.4e+03	+	1.3e+03	+
	(1.4e+02)	(3.5e+01)		(3.1e+02)		(2.8e+02)	
f_{28}	9.8e+02	2.0e+03	+	9.5e+02	+	7.0e+02	+
	(1.2e+03)	(1.1e+02)		(1.2e+03)		(9.3e+02)	
Summary (+/·/−)		23/3/2		13/8/7		13/12/3	

Table 205: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	3.2e−04	4.9e−04	+	4.4e+01	+	4.5e−05	−
	(6.7e−05)	(7.6e−05)		(1.2e+01)		(5.2e−06)	
f_2	4.5e+08	4.7e+08	·	3.9e+08	−	3.8e+08	−
	(5.5e+07)	(6.0e+07)		(7.5e+07)		(4.9e+07)	
f_3	1.4e+10	1.3e+10	·	5.1e+10	+	1.5e+10	+
	(1.6e+09)	(1.5e+09)		(6.9e+09)		(1.8e+09)	
f_4	1.2e+05	1.2e+05	·	8.7e+04	−	1.1e+05	−
	(9.5e+03)	(1.3e+04)		(1.2e+04)		(8.2e+03)	
f_5	2.0e−02	3.5e−02	+	2.0e+01	+	3.3e−03	−
	(2.6e−03)	(3.4e−03)		(3.6e+00)		(2.7e−04)	
f_6	4.7e+01	4.7e+01	·	5.9e+01	+	4.7e+01	−
	(1.6e−01)	(1.7e−01)		(4.6e+00)		(1.6e−01)	
f_7	1.1e+02	1.1e+02	·	1.5e+02	+	1.1e+02	·
	(5.5e+00)	(5.2e+00)		(1.0e+01)		(5.1e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.3e−02)	(3.7e−02)		(3.9e−02)		(2.9e−02)	
f_9	7.3e+01	7.2e+01	·	7.3e+01	·	7.2e+01	·
	(1.5e+00)	(1.9e+00)		(1.3e+00)		(1.6e+00)	
f_{10}	8.3e+02	7.4e+02	−	1.5e+03	+	8.1e+02	·
	(9.0e+01)	(9.4e+01)		(2.7e+02)		(7.0e+01)	
f_{11}	2.9e+02	2.6e+02	−	1.5e+02	−	2.9e+02	·
	(1.2e+01)	(1.4e+01)		(1.8e+01)		(1.1e+01)	
f_{12}	4.2e+02	4.2e+02	·	5.0e+02	+	4.2e+02	·
	(1.6e+01)	(1.6e+01)		(2.0e+01)		(1.4e+01)	
f_{13}	4.2e+02	4.2e+02	·	5.0e+02	+	4.2e+02	·
	(1.4e+01)	(1.4e+01)		(2.4e+01)		(1.3e+01)	
f_{14}	1.1e+04	9.3e+03	−	3.2e+03	−	1.1e+04	·
	(3.1e+02)	(4.0e+02)		(6.3e+02)		(3.2e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.2e+02)	(3.3e+02)		(3.8e+02)		(3.2e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.3e+00	·	3.4e+00	·
	(2.6e−01)	(2.6e−01)		(3.1e−01)		(2.9e−01)	
f_{17}	3.6e+02	3.3e+02	−	2.9e+02	−	3.5e+02	·
	(1.1e+01)	(1.5e+01)		(2.7e+01)		(1.1e+01)	
f_{18}	4.6e+02	4.6e+02	·	5.6e+02	+	4.7e+02	·
	(1.7e+01)	(1.7e+01)		(2.4e+01)		(1.3e+01)	
f_{19}	3.2e+01	3.2e+01	·	4.8e+01	+	3.2e+01	·
	(1.5e+00)	(9.8e−01)		(4.3e+00)		(9.8e−01)	
f_{20}	2.3e+01	2.3e+01	·	2.3e+01	+	2.3e+01	·
	(2.3e−01)	(1.9e−01)		(2.5e−01)		(1.8e−01)	
f_{21}	3.7e+02	2.5e+02	·	9.9e+02	+	1.1e+03	+
	(3.0e+02)	(1.3e+02)		(5.7e+02)		(2.9e+02)	
f_{22}	1.1e+04	9.8e+03	−	3.5e+03	−	1.1e+04	+
	(3.4e+02)	(4.8e+02)		(5.2e+02)		(3.5e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.5e+04	·
	(3.2e+02)	(3.9e+02)		(3.9e+02)		(3.7e+02)	
f_{24}	3.6e+02	3.6e+02	+	3.7e+02	+	3.5e+02	−
	(4.7e+00)	(4.3e+00)		(8.0e+00)		(4.8e+00)	
f_{25}	4.0e+02	4.0e+02	·	3.9e+02	·	4.1e+02	+
	(4.0e+00)	(3.5e+00)		(1.6e+01)		(4.0e+00)	
f_{26}	3.9e+02	3.8e+02	·	3.8e+02	·	3.7e+02	·
	(4.6e+01)	(3.8e+01)		(1.2e+02)		(4.0e+01)	
f_{27}	2.1e+03	2.1e+03	·	2.1e+03	·	2.1e+03	−
	(4.5e+01)	(4.2e+01)		(5.2e+01)		(3.4e+01)	
f_{28}	4.0e+02	4.0e+02	+	7.9e+02	+	4.0e+02	−
	(2.1e−02)	(1.6e−02)		(1.0e+03)		(5.0e−03)	
Summary (+/·/−)		4/19/5		14/8/6		4/16/8	

Table 206: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.5}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.6e−09	0.0e+00	·	8.4e−04	+	1.0e−01	+
	(1.2e−08)	(0.0e+00)		(3.5e−04)		(4.4e−02)	
f_2	4.1e+07	3.3e+08	+	2.8e+08	+	2.9e+08	+
	(6.6e+06)	(4.6e+07)		(5.9e+07)		(5.7e+07)	
f_3	4.3e+06	1.2e+06	−	2.6e+10	+	4.0e+10	+
	(4.9e+06)	(4.3e+06)		(6.2e+09)		(5.2e+09)	
f_4	4.3e+04	1.1e+05	+	7.2e+04	+	7.1e+04	+
	(4.2e+03)	(9.3e+03)		(9.1e+03)		(7.4e+03)	
f_5	1.5e+01	0.0e+00	−	4.5e−02	−	7.9e−01	−
	(1.2e+01)	(0.0e+00)		(1.5e−02)		(2.9e−01)	
f_6	5.4e+01	4.8e+01	·	4.7e+01	−	4.7e+01	−
	(1.5e+01)	(2.6e−01)		(9.1e−01)		(9.4e−01)	
f_7	3.6e+00	1.5e+01	+	1.2e+02	+	1.3e+02	+
	(3.3e+00)	(3.4e+00)		(1.2e+01)		(1.0e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.0e−02)	(3.4e−02)		(3.9e−02)		(3.8e−02)	
f_9	6.9e+01	7.2e+01	+	7.3e+01	+	7.2e+01	+
	(1.4e+00)	(1.6e+00)		(1.1e+00)		(1.4e+00)	
f_{10}	3.7e+01	3.1e+00	−	2.9e+02	+	9.5e+02	+
	(1.8e+01)	(1.0e+00)		(1.1e+02)		(2.0e+02)	
f_{11}	2.3e+02	1.3e+02	−	1.1e+02	−	3.5e+02	+
	(1.1e+01)	(8.6e+00)		(2.0e+01)		(1.6e+01)	
f_{12}	3.4e+02	3.4e+02	·	4.4e+02	+	4.6e+02	+
	(1.2e+01)	(1.0e+01)		(2.0e+01)		(2.2e+01)	
f_{13}	3.4e+02	3.5e+02	·	4.5e+02	+	4.6e+02	+
	(1.6e+01)	(1.4e+01)		(2.5e+01)		(1.9e+01)	
f_{14}	1.1e+04	8.2e+03	−	3.2e+03	−	1.1e+04	+
	(3.2e+02)	(3.0e+02)		(7.5e+02)		(3.1e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	+	1.4e+04	·
	(3.7e+02)	(3.9e+02)		(3.8e+02)		(3.8e+02)	
f_{16}	3.4e+00	3.3e+00	·	3.3e+00	·	3.4e+00	·
	(2.2e−01)	(3.2e−01)		(3.0e−01)		(2.2e−01)	
f_{17}	2.8e+02	2.5e+02	−	2.1e+02	−	4.3e+02	+
	(9.7e+00)	(1.1e+01)		(1.3e+01)		(1.9e+01)	
f_{18}	3.8e+02	3.9e+02	+	4.9e+02	+	5.2e+02	+
	(1.1e+01)	(1.2e+01)		(1.9e+01)		(2.5e+01)	
f_{19}	2.4e+01	2.4e+01	·	3.2e+01	+	3.9e+01	+
	(1.3e+00)	(1.3e+00)		(2.1e+00)		(2.0e+00)	
f_{20}	2.2e+01	2.2e+01	+	2.3e+01	+	2.3e+01	+
	(2.3e−01)	(2.5e−01)		(2.8e−01)		(2.7e−01)	
f_{21}	9.0e+02	3.8e+02	−	8.1e+02	·	7.8e+02	·
	(3.6e+02)	(3.5e+02)		(4.2e+02)		(4.4e+02)	
f_{22}	1.0e+04	7.7e+03	−	3.2e+03	−	1.1e+04	+
	(3.4e+02)	(4.8e+02)		(8.2e+02)		(3.7e+02)	
f_{23}	1.4e+04	1.4e+04	+	1.4e+04	+	1.4e+04	+
	(3.7e+02)	(3.2e+02)		(5.1e+02)		(4.1e+02)	
f_{24}	2.1e+02	2.2e+02	·	3.5e+02	+	3.6e+02	+
	(1.2e+01)	(1.9e+01)		(1.3e+01)		(8.5e+00)	
f_{25}	2.8e+02	3.7e+02	+	3.6e+02	+	3.7e+02	+
	(1.3e+01)	(2.0e+01)		(2.5e+01)		(1.6e+01)	
f_{26}	2.2e+02	3.7e+02	+	4.1e+02	+	4.0e+02	+
	(2.6e+01)	(4.9e+01)		(1.1e+02)		(1.1e+02)	
f_{27}	5.3e+02	2.0e+03	+	2.0e+03	+	2.0e+03	+
	(1.9e+02)	(7.7e+01)		(1.1e+02)		(8.5e+01)	
f_{28}	5.8e+02	4.0e+02	−	9.9e+02	·	1.1e+03	+
	(7.1e+02)	(8.2e−11)		(1.3e+03)		(1.4e+03)	
Summary (+/·/−)		10/9/9		18/4/6		22/4/2	

Table 207: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	3.1e−01	3.1e−01	·	1.2e+01	+	1.3e−01	−
	(5.8e−02)	(5.4e−02)		(4.0e+00)		(1.4e−02)	
f_2	4.2e+08	4.2e+08	·	2.7e+08	−	3.7e+08	·
	(5.3e+07)	(5.6e+07)		(7.0e+07)		(4.4e+07)	
f_3	1.6e+10	1.6e+10	·	4.4e+10	+	2.4e+10	+
	(1.9e+09)	(1.9e+09)		(8.4e+09)		(1.9e+09)	
f_4	1.1e+05	1.1e+05	·	8.3e+04	−	1.1e+05	·
	(1.1e+04)	(9.5e+03)		(8.2e+03)		(7.4e+03)	
f_5	9.6e−01	9.9e−01	·	1.3e+01	+	5.0e−01	−
	(1.0e−01)	(1.4e−01)		(3.0e+00)		(4.4e−02)	
f_6	4.8e+01	4.8e+01	·	5.0e+01	+	4.7e+01	−
	(2.0e−01)	(1.7e−01)		(1.1e+00)		(1.4e−01)	
f_7	1.1e+02	1.1e+02	·	1.5e+02	+	1.1e+02	+
	(5.3e+00)	(4.9e+00)		(1.8e+01)		(5.3e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.2e−02)	(3.7e−02)		(3.8e−02)		(3.0e−02)	
f_9	7.3e+01	7.3e+01	·	7.2e+01	·	7.3e+01	·
	(1.2e+00)	(1.4e+00)		(1.8e+00)		(1.2e+00)	
f_{10}	5.8e+02	5.5e+02	·	3.1e+02	−	1.1e+03	+
	(1.0e+02)	(6.5e+01)		(1.2e+02)		(1.1e+02)	
f_{11}	3.1e+02	3.2e+02	·	7.4e+01	−	3.5e+02	+
	(1.4e+01)	(1.4e+01)		(1.5e+01)		(1.2e+01)	
f_{12}	4.2e+02	4.2e+02	·	4.7e+02	+	4.4e+02	+
	(1.9e+01)	(1.3e+01)		(2.6e+01)		(1.7e+01)	
f_{13}	4.2e+02	4.2e+02	·	4.7e+02	+	4.4e+02	+
	(1.6e+01)	(1.4e+01)		(2.5e+01)		(1.6e+01)	
f_{14}	1.1e+04	1.1e+04	·	1.6e+03	−	1.2e+04	+
	(3.9e+02)	(4.1e+02)		(4.5e+02)		(3.2e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.6e+02)	(3.7e+02)		(5.3e+02)		(4.0e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.4e+00	·	3.4e+00	·
	(2.5e−01)	(2.6e−01)		(2.7e−01)		(2.4e−01)	
f_{17}	3.9e+02	3.9e+02	·	1.6e+02	−	4.3e+02	+
	(1.5e+01)	(1.8e+01)		(1.9e+01)		(1.3e+01)	
f_{18}	4.7e+02	4.7e+02	·	5.3e+02	+	4.9e+02	+
	(1.8e+01)	(1.5e+01)		(2.1e+01)		(1.4e+01)	
f_{19}	3.6e+01	3.5e+01	·	2.7e+01	−	3.7e+01	+
	(1.3e+00)	(1.6e+00)		(5.6e+00)		(1.5e+00)	
f_{20}	2.3e+01	2.3e+01	·	2.3e+01	+	2.3e+01	·
	(2.6e−01)	(2.4e−01)		(2.7e−01)		(1.7e−01)	
f_{21}	2.1e+02	2.1e+02	·	7.6e+02	+	2.6e+02	−
	(1.1e+00)	(1.7e+00)		(4.6e+02)		(2.7e+02)	
f_{22}	1.1e+04	1.1e+04	·	1.8e+03	−	1.2e+04	+
	(5.1e+02)	(5.2e+02)		(3.7e+02)		(3.2e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(4.0e+02)	(3.7e+02)		(4.3e+02)		(3.5e+02)	
f_{24}	3.5e+02	3.6e+02	·	3.6e+02	+	3.5e+02	−
	(7.1e+00)	(4.7e+00)		(1.7e+01)		(4.5e+00)	
f_{25}	4.0e+02	4.0e+02	·	3.7e+02	−	4.1e+02	+
	(4.4e+00)	(5.1e+00)		(2.0e+01)		(3.5e+00)	
f_{26}	3.8e+02	3.3e+02	·	4.0e+02	·	4.4e+02	·
	(7.4e+01)	(6.6e+01)		(1.2e+02)		(4.4e+01)	
f_{27}	2.1e+03	2.1e+03	·	2.1e+03	·	2.1e+03	·
	(4.8e+01)	(4.7e+01)		(9.5e+01)		(4.6e+01)	
f_{28}	4.0e+02	4.0e+02	·	6.9e+02	+	4.0e+02	−
	(4.0e−01)	(3.2e−01)		(9.1e+02)		(1.8e−01)	
Summary (+/·/−)		0/28/0		12/7/9		12/10/6	

Table 208: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	4.0e+03	1.4e+03	−	2.3e+02	−	4.1e+03	·
	(5.0e+02)	(1.6e+02)		(7.4e+01)		(3.3e+02)	
f_2	5.7e+08	5.4e+08	·	3.7e+08	−	5.5e+08	·
	(7.9e+07)	(8.5e+07)		(1.2e+08)		(8.9e+07)	
f_3	7.2e+10	6.4e+10	−	6.4e+10	·	7.2e+10	·
	(6.0e+09)	(5.6e+09)		(1.3e+10)		(6.3e+09)	
f_4	1.2e+05	1.2e+05	·	9.8e+04	−	1.2e+05	·
	(8.9e+03)	(9.4e+03)		(9.6e+03)		(1.2e+04)	
f_5	2.7e+02	1.6e+02	−	8.7e+01	−	2.2e+02	−
	(2.0e+01)	(1.5e+01)		(1.9e+01)		(1.3e+01)	
f_6	4.8e+02	2.2e+02	−	8.8e+01	−	5.6e+02	+
	(4.1e+01)	(1.9e+01)		(3.7e+01)		(5.4e+01)	
f_7	1.7e+02	1.7e+02	−	1.7e+02	·	1.7e+02	·
	(6.1e+00)	(7.6e+00)		(1.6e+01)		(6.6e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.8e−02)	(4.1e−02)		(3.7e−02)		(3.4e−02)	
f_9	7.3e+01	7.2e+01	·	7.3e+01	·	7.3e+01	·
	(1.2e+00)	(1.5e+00)		(1.5e+00)		(1.2e+00)	
f_{10}	3.1e+03	2.3e+03	−	6.1e+02	−	3.2e+03	·
	(2.4e+02)	(3.1e+02)		(2.2e+02)		(3.0e+02)	
f_{11}	4.6e+02	4.0e+02	−	6.0e+01	−	4.7e+02	·
	(1.8e+01)	(1.5e+01)		(1.1e+01)		(1.6e+01)	
f_{12}	5.8e+02	5.0e+02	−	5.1e+02	−	5.9e+02	·
	(2.8e+01)	(2.4e+01)		(3.1e+01)		(2.2e+01)	
f_{13}	5.8e+02	5.1e+02	−	5.2e+02	−	5.9e+02	·
	(2.3e+01)	(2.2e+01)		(2.7e+01)		(1.8e+01)	
f_{14}	1.2e+04	1.1e+04	−	9.1e+02	−	1.2e+04	·
	(3.2e+02)	(4.4e+02)		(2.1e+02)		(3.3e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.6e+02)	(3.8e+02)		(3.2e+02)		(3.4e+02)	
f_{16}	3.3e+00	3.4e+00	·	3.4e+00	·	3.3e+00	·
	(3.3e−01)	(2.1e−01)		(2.5e−01)		(3.8e−01)	
f_{17}	8.0e+02	5.7e+02	−	1.8e+02	−	8.2e+02	+
	(3.6e+01)	(3.0e+01)		(2.2e+01)		(3.0e+01)	
f_{18}	8.3e+02	6.0e+02	−	5.7e+02	−	8.7e+02	+
	(3.9e+01)	(2.7e+01)		(3.1e+01)		(2.6e+01)	
f_{19}	1.1e+03	1.2e+02	−	6.4e+01	−	9.3e+02	·
	(3.5e+02)	(3.4e+01)		(2.9e+01)		(2.4e+02)	
f_{20}	2.3e+01	2.3e+01	·	2.3e+01	·	2.3e+01	·
	(2.6e−01)	(1.8e−01)		(2.4e−01)		(2.2e−01)	
f_{21}	1.2e+03	8.8e+02	−	1.1e+03	·	1.3e+03	·
	(6.8e+01)	(4.0e+01)		(5.4e+02)		(4.7e+01)	
f_{22}	1.3e+04	1.1e+04	−	1.0e+03	−	1.3e+04	+
	(4.1e+02)	(4.5e+02)		(2.7e+02)		(3.3e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.5e+04	·
	(2.9e+02)	(3.3e+02)		(4.6e+02)		(2.6e+02)	
f_{24}	3.8e+02	3.8e+02	·	3.8e+02	·	3.9e+02	·
	(4.0e+00)	(4.3e+00)		(9.8e+00)		(3.5e+00)	
f_{25}	4.2e+02	4.2e+02	·	4.1e+02	−	4.3e+02	+
	(3.7e+00)	(5.3e+00)		(1.1e+01)		(4.0e+00)	
f_{26}	4.1e+02	4.0e+02	·	4.0e+02	·	4.4e+02	·
	(4.2e+01)	(5.0e+01)		(1.1e+02)		(3.6e+01)	
f_{27}	2.2e+03	2.2e+03	·	2.2e+03	·	2.2e+03	·
	(4.0e+01)	(3.3e+01)		(5.7e+01)		(4.5e+01)	
f_{28}	9.7e+02	7.1e+02	−	8.5e+02	−	9.5e+02	·
	(4.3e+01)	(2.5e+01)		(1.0e+03)		(3.5e+01)	
Summary (+/·/−)		0/12/16		0/12/16		5/22/1	

Table 209: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.7e+01	3.5e+04	+	2.3e+01	·	5.8e+00	·
	(2.4e+01)	(3.2e+03)		(3.6e+01)		(6.7e+00)	
f_2	8.1e+06	7.6e+08	+	9.3e+06	·	1.4e+07	+
	(3.9e+06)	(9.8e+07)		(4.7e+06)		(5.3e+06)	
f_3	7.4e+08	1.5e+11	+	5.8e+08	·	1.5e+09	·
	(1.2e+09)	(1.7e+10)		(9.8e+08)		(2.7e+09)	
f_4	1.8e+04	1.3e+05	+	1.8e+04	·	1.9e+04	·
	(4.3e+03)	(1.0e+04)		(3.4e+03)		(3.1e+03)	
f_5	1.4e+02	7.1e+03	+	1.3e+02	·	9.9e+01	·
	(7.4e+01)	(8.1e+02)		(6.7e+01)		(7.0e+01)	
f_6	1.1e+02	2.5e+03	+	9.8e+01	·	8.1e+01	−
	(4.8e+01)	(3.0e+02)		(4.7e+01)		(4.0e+01)	
f_7	9.3e+01	2.4e+02	+	1.0e+02	·	9.3e+01	·
	(3.1e+01)	(2.0e+01)		(3.1e+01)		(2.8e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.5e−02)	(3.7e−02)		(2.8e−02)		(4.3e−02)	
f_9	3.0e+01	7.3e+01	+	3.0e+01	·	2.3e+01	−
	(3.7e+00)	(1.2e+00)		(4.7e+00)		(2.7e+00)	
f_{10}	2.5e+02	5.9e+03	+	2.5e+02	·	1.7e+02	·
	(1.4e+02)	(4.6e+02)		(1.2e+02)		(1.2e+02)	
f_{11}	1.6e+02	7.9e+02	+	1.7e+02	·	1.3e+02	·
	(3.7e+01)	(4.4e+01)		(4.1e+01)		(3.8e+01)	
f_{12}	1.7e+02	8.7e+02	+	2.0e+02	·	3.9e+02	+
	(6.2e+01)	(4.9e+01)		(8.2e+01)		(7.2e+01)	
f_{13}	4.0e+02	8.8e+02	+	4.0e+02	·	4.3e+02	·
	(6.9e+01)	(4.9e+01)		(6.8e+01)		(3.6e+01)	
f_{14}	3.4e+03	1.1e+04	+	3.2e+03	·	1.1e+04	+
	(7.1e+02)	(5.3e+02)		(6.4e+02)		(6.1e+02)	
f_{15}	1.4e+04	1.4e+04	+	1.4e+04	·	1.4e+04	·
	(4.4e+02)	(3.4e+02)		(5.1e+02)		(4.5e+02)	
f_{16}	3.3e+00	3.4e+00	·	3.3e+00	·	3.3e+00	·
	(2.7e−01)	(2.7e−01)		(2.5e−01)		(2.6e−01)	
f_{17}	2.1e+02	1.8e+03	+	2.1e+02	·	4.0e+02	+
	(4.4e+01)	(1.0e+02)		(4.7e+01)		(3.3e+01)	
f_{18}	4.9e+02	1.8e+03	+	5.0e+02	·	4.7e+02	·
	(4.7e+01)	(1.2e+02)		(4.9e+01)		(3.8e+01)	
f_{19}	3.1e+01	1.0e+05	+	3.4e+01	·	2.9e+01	·
	(2.6e+01)	(2.5e+04)		(3.6e+01)		(1.0e+01)	
f_{20}	2.2e+01	2.4e+01	+	2.2e+01	·	2.2e+01	·
	(6.3e−01)	(2.2e−01)		(5.6e−01)		(5.5e−01)	
f_{21}	9.2e+02	4.8e+03	+	8.8e+02	·	8.0e+02	·
	(3.6e+02)	(4.2e+02)		(3.7e+02)		(4.0e+02)	
f_{22}	4.2e+03	1.2e+04	+	4.1e+03	·	9.4e+03	+
	(7.7e+02)	(4.6e+02)		(1.3e+03)		(3.1e+03)	
f_{23}	1.4e+04	1.5e+04	+	1.4e+04	·	1.4e+04	·
	(6.7e+02)	(3.0e+02)		(6.9e+02)		(5.0e+02)	
f_{24}	3.0e+02	4.1e+02	+	3.0e+02	·	2.9e+02	−
	(1.4e+01)	(4.5e+00)		(1.0e+01)		(1.1e+01)	
f_{25}	3.3e+02	4.5e+02	+	3.3e+02	·	3.2e+02	−
	(1.3e+01)	(5.6e+00)		(1.4e+01)		(1.2e+01)	
f_{26}	3.7e+02	4.0e+02	·	3.7e+02	·	3.6e+02	−
	(3.6e+01)	(3.8e+01)		(5.0e+01)		(4.0e+01)	
f_{27}	1.2e+03	2.2e+03	+	1.2e+03	·	1.1e+03	−
	(1.1e+02)	(4.5e+01)		(1.1e+02)		(1.2e+02)	
f_{28}	1.2e+03	5.0e+03	+	1.3e+03	·	1.3e+03	·
	(1.3e+03)	(2.9e+02)		(1.4e+03)		(1.4e+03)	
Summary (+/·/−)		25/3/0		0/28/0		5/17/6	

Table 210: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	5.1e−05	4.6e+02	+	1.9e−07	−	1.6e−04	+
	(3.0e−05)	(1.2e+02)		(1.2e−07)		(1.3e−04)	
f_2	1.7e+08	7.8e+07	−	1.2e+08	−	1.7e+08	·
	(3.7e+07)	(3.0e+07)		(3.2e+07)		(4.7e+07)	
f_3	2.3e+10	8.4e+09	−	1.3e+10	−	2.5e+10	·
	(6.9e+09)	(2.4e+09)		(7.7e+09)		(5.1e+09)	
f_4	6.0e+04	9.7e+04	+	5.9e+04	·	5.8e+04	·
	(7.9e+03)	(1.0e+04)		(8.6e+03)		(7.4e+03)	
f_5	5.3e−03	3.0e+02	+	1.6e−04	−	1.2e−02	+
	(2.1e−03)	(1.2e+02)		(1.3e−04)		(5.7e−03)	
f_6	4.6e+01	7.5e+01	+	4.6e+01	·	4.6e+01	·
	(1.1e+00)	(8.9e+00)		(1.2e+00)		(1.4e+00)	
f_7	1.2e+02	4.8e+01	−	9.9e+01	−	1.2e+02	·
	(1.5e+01)	(6.8e+00)		(2.1e+01)		(1.6e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.0e−02)	(3.8e−02)		(3.3e−02)		(3.8e−02)	
f_9	7.0e+01	6.8e+01	·	6.6e+01	·	7.1e+01	·
	(4.0e+00)	(4.6e+00)		(9.6e+00)		(1.9e+00)	
f_{10}	7.3e+01	2.0e+02	+	4.9e+00	−	1.7e+02	+
	(2.6e+01)	(6.0e+01)		(2.0e+00)		(5.5e+01)	
f_{11}	3.6e+02	8.4e+01	−	8.5e+01	−	3.7e+02	·
	(2.1e+01)	(1.1e+01)		(1.8e+01)		(1.9e+01)	
f_{12}	4.3e+02	3.1e+02	−	4.2e+02	−	4.4e+02	·
	(1.9e+01)	(2.6e+01)		(2.4e+01)		(2.1e+01)	
f_{13}	4.3e+02	3.2e+02	−	4.3e+02	·	4.4e+02	·
	(2.1e+01)	(1.6e+01)		(2.0e+01)		(2.1e+01)	
f_{14}	1.2e+04	3.6e+02	−	2.0e+03	−	1.2e+04	·
	(4.9e+02)	(8.8e+01)		(4.1e+02)		(3.9e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(4.1e+02)	(3.7e+02)		(4.1e+02)		(4.0e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.3e+00	·	3.4e+00	·
	(2.7e−01)	(2.8e−01)		(3.4e−01)		(2.7e−01)	
f_{17}	4.3e+02	2.0e+02	−	1.3e+02	−	4.4e+02	·
	(2.1e+01)	(1.7e+01)		(1.8e+01)		(2.3e+01)	
f_{18}	4.9e+02	3.9e+02	−	4.7e+02	−	4.9e+02	·
	(2.1e+01)	(1.3e+01)		(1.8e+01)		(2.0e+01)	
f_{19}	3.5e+01	3.1e+01	−	9.2e+00	−	3.6e+01	·
	(2.1e+00)	(4.7e+00)		(2.5e+00)		(2.0e+00)	
f_{20}	2.3e+01	2.2e+01	−	2.3e+01	·	2.3e+01	·
	(2.8e−01)	(2.7e−01)		(2.9e−01)		(2.6e−01)	
f_{21}	7.8e+02	1.1e+03	·	7.3e+02	−	7.5e+02	·
	(4.2e+02)	(4.4e+02)		(4.4e+02)		(4.3e+02)	
f_{22}	1.2e+04	6.6e+02	−	2.3e+03	−	1.2e+04	·
	(6.8e+02)	(1.3e+02)		(5.9e+02)		(4.7e+02)	
f_{23}	1.4e+04	1.4e+04	−	1.4e+04	·	1.4e+04	·
	(4.1e+02)	(4.0e+02)		(4.3e+02)		(5.5e+02)	
f_{24}	3.3e+02	2.9e+02	−	2.9e+02	−	3.4e+02	·
	(2.0e+01)	(9.0e+00)		(1.7e+01)		(1.8e+01)	
f_{25}	3.3e+02	3.3e+02	·	3.1e+02	−	3.4e+02	·
	(1.6e+01)	(7.6e+00)		(1.1e+01)		(1.8e+01)	
f_{26}	4.4e+02	2.7e+02	−	4.0e+02	−	4.4e+02	·
	(6.9e+01)	(7.8e+01)		(7.6e+01)		(6.8e+01)	
f_{27}	1.7e+03	1.3e+03	−	1.4e+03	−	1.9e+03	+
	(2.0e+02)	(1.1e+02)		(2.6e+02)		(1.6e+02)	
f_{28}	1.1e+03	7.0e+02	+	1.1e+03	−	9.2e+02	·
	(1.4e+03)	(9.8e+01)		(1.3e+03)		(1.2e+03)	
Summary (+/·/−)		6/6/16		0/9/19		4/24/0	

Table 211: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.3e−04	4.8e+02	+	1.7e−07	+	0.0e+00	·
	(9.0e−04)	(1.6e+02)		(1.6e−07)		(0.0e+00)	
f_2	4.0e+07	7.4e+07	+	1.2e+08	+	7.1e+07	+
	(5.0e+06)	(3.1e+07)		(4.4e+07)		(8.7e+06)	
f_3	7.1e+05	7.9e+09	+	1.1e+10	+	8.0e+05	·
	(1.4e+06)	(3.0e+09)		(5.4e+09)		(1.0e+06)	
f_4	6.3e+04	9.8e+04	+	5.9e+04	·	6.2e+04	·
	(4.8e+03)	(8.1e+03)		(6.1e+03)		(6.7e+03)	
f_5	2.1e+01	2.7e+02	+	1.6e−04	−	6.2e−01	−
	(9.2e+00)	(1.1e+02)		(8.0e−05)		(1.4e+00)	
f_6	4.8e+01	7.7e+01	+	4.6e+01	−	4.7e+01	−
	(5.4e−01)	(9.6e+00)		(1.3e+00)		(2.9e−01)	
f_7	3.2e+00	4.9e+01	+	1.0e+02	+	5.2e+00	+
	(2.2e+00)	(7.4e+00)		(2.1e+01)		(2.1e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.1e−02)	(3.3e−02)		(3.5e−02)		(4.7e−02)	
f_9	7.0e+01	6.9e+01	·	6.6e+01	·	7.1e+01	·
	(1.5e+00)	(3.1e+00)		(9.2e+00)		(1.7e+00)	
f_{10}	2.2e+01	1.8e+02	+	4.9e+00	−	1.0e+01	−
	(6.6e+00)	(5.6e+01)		(2.5e+00)		(2.6e+00)	
f_{11}	2.8e+02	8.2e+01	−	8.2e+01	−	2.6e+02	−
	(1.0e+01)	(1.1e+01)		(2.0e+01)		(1.3e+01)	
f_{12}	3.5e+02	3.1e+02	−	4.2e+02	+	3.3e+02	−
	(1.3e+01)	(2.9e+01)		(2.6e+01)		(1.4e+01)	
f_{13}	3.5e+02	3.2e+02	−	4.2e+02	+	3.3e+02	−
	(1.3e+01)	(1.5e+01)		(1.7e+01)		(1.1e+01)	
f_{14}	1.2e+04	3.5e+02	−	2.0e+03	−	1.2e+04	·
	(4.0e+02)	(8.0e+01)		(4.3e+02)		(3.0e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.6e+02)	(3.0e+02)		(4.7e+02)		(2.9e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.4e+00	·	3.3e+00	·
	(2.7e−01)	(2.8e−01)		(2.8e−01)		(2.9e−01)	
f_{17}	3.2e+02	2.0e+02	−	1.4e+02	−	3.2e+02	·
	(1.1e+01)	(2.0e+01)		(1.5e+01)		(1.1e+01)	
f_{18}	3.8e+02	3.8e+02	·	4.7e+02	+	3.7e+02	−
	(9.4e+00)	(1.4e+01)		(2.1e+01)		(1.4e+01)	
f_{19}	2.9e+01	2.9e+01	·	9.1e+00	−	2.5e+01	−
	(2.1e+00)	(6.1e+00)		(2.7e+00)		(1.1e+00)	
f_{20}	2.2e+01	2.2e+01	·	2.2e+01	+	2.2e+01	−
	(2.7e−01)	(2.8e−01)		(3.5e−01)		(2.1e−01)	
f_{21}	7.8e+02	1.2e+03	·	7.9e+02	·	9.8e+02	·
	(3.3e+02)	(3.9e+02)		(4.3e+02)		(2.6e+02)	
f_{22}	1.2e+04	6.5e+02	−	2.3e+03	−	1.1e+04	−
	(3.4e+02)	(1.3e+02)		(5.7e+02)		(3.3e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	+	1.3e+04	−
	(4.0e+02)	(5.0e+02)		(4.1e+02)		(4.5e+02)	
f_{24}	2.0e+02	2.9e+02	+	2.9e+02	+	2.0e+02	−
	(1.7e+00)	(9.1e+00)		(1.6e+01)		(9.4e−01)	
f_{25}	3.0e+02	3.3e+02	+	3.1e+02	·	2.8e+02	−
	(2.0e+01)	(9.3e+00)		(1.2e+01)		(8.3e+00)	
f_{26}	2.0e+02	2.7e+02	+	4.0e+02	+	3.2e+02	+
	(5.2e−01)	(7.8e+01)		(6.6e+01)		(1.5e+01)	
f_{27}	3.6e+02	1.2e+03	+	1.4e+03	+	3.1e+02	−
	(2.7e+01)	(1.1e+02)		(2.7e+02)		(2.2e+01)	
f_{28}	4.0e+02	7.0e+02	+	9.6e+02	·	4.0e+02	−
	(2.3e−01)	(9.3e+01)		(1.2e+03)		(1.4e−13)	
Summary (+/·/−)		13/9/6		12/8/8		3/10/15	

Table 212: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	2.0e−01	1.7e+04	+	0.0e+00	−	0.0e+00	−
	(4.8e−01)	(1.5e+03)		(0.0e+00)		(0.0e+00)	
f_2	2.1e+06	5.3e+08	+	2.9e+07	+	3.6e+07	+
	(9.9e+05)	(6.8e+07)		(1.2e+07)		(1.1e+07)	
f_3	1.4e+08	8.3e+10	+	2.2e+09	+	1.4e+08	·
	(4.3e+08)	(6.3e+09)		(2.5e+09)		(2.1e+08)	
f_4	1.5e+04	1.1e+05	+	3.9e+04	+	2.8e+04	+
	(2.7e+03)	(1.0e+04)		(5.5e+03)		(3.5e+03)	
f_5	8.0e+01	3.4e+03	+	0.0e+00	−	0.0e+00	−
	(4.5e+01)	(3.7e+02)		(0.0e+00)		(0.0e+00)	
f_6	8.0e+01	1.1e+03	+	4.4e+01	−	4.9e+01	−
	(3.2e+01)	(1.3e+02)		(1.1e+00)		(9.2e+00)	
f_7	3.8e+01	1.8e+02	+	8.0e+01	+	4.2e+01	·
	(2.1e+01)	(8.4e+00)		(2.3e+01)		(1.9e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.4e−02)	(3.7e−02)		(3.2e−02)		(3.0e−02)	
f_9	2.1e+01	7.3e+01	+	2.4e+01	·	4.1e+01	+
	(8.1e+00)	(1.3e+00)		(1.0e+01)		(2.2e+01)	
f_{10}	9.8e+01	3.5e+03	+	4.0e−02	−	2.5e−01	−
	(4.6e+01)	(3.1e+02)		(2.0e−02)		(5.0e−01)	
f_{11}	1.4e+02	5.6e+02	+	1.0e+02	·	3.0e+02	+
	(9.0e+01)	(3.2e+01)		(2.6e+01)		(1.6e+01)	
f_{12}	3.7e+02	6.7e+02	+	4.0e+02	+	3.7e+02	·
	(2.6e+01)	(3.0e+01)		(2.4e+01)		(1.8e+01)	
f_{13}	3.8e+02	6.7e+02	+	4.0e+02	+	3.7e+02	·
	(2.3e+01)	(2.6e+01)		(2.7e+01)		(2.1e+01)	
f_{14}	1.2e+04	1.0e+04	−	2.4e+03	−	1.2e+04	·
	(5.4e+02)	(4.9e+02)		(5.3e+02)		(5.2e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	+	1.4e+04	·
	(3.4e+02)	(3.9e+02)		(3.3e+02)		(4.0e+02)	
f_{16}	3.4e+00	3.3e+00	·	3.3e+00	·	3.3e+00	·
	(3.1e−01)	(2.6e−01)		(2.9e−01)		(2.3e−01)	
f_{17}	3.5e+02	1.2e+03	+	1.4e+02	−	3.5e+02	·
	(2.1e+01)	(5.6e+01)		(2.0e+01)		(1.6e+01)	
f_{18}	4.1e+02	1.2e+03	+	4.5e+02	+	4.1e+02	·
	(1.9e+01)	(5.8e+01)		(2.2e+01)		(2.1e+01)	
f_{19}	2.7e+01	1.1e+04	+	7.1e+00	−	2.8e+01	·
	(3.6e+00)	(3.0e+03)		(2.0e+00)		(1.7e+00)	
f_{20}	2.2e+01	2.3e+01	+	2.2e+01	+	2.2e+01	·
	(3.3e−01)	(1.9e−01)		(4.1e−01)		(3.9e−01)	
f_{21}	8.2e+02	2.8e+03	+	7.6e+02	−	8.7e+02	−
	(4.1e+02)	(2.9e+02)		(4.4e+02)		(3.9e+02)	
f_{22}	1.1e+04	1.1e+04	−	2.8e+03	−	1.2e+04	·
	(4.9e+02)	(4.6e+02)		(6.2e+02)		(5.3e+02)	
f_{23}	1.4e+04	1.4e+04	+	1.4e+04	·	1.4e+04	·
	(4.5e+02)	(3.5e+02)		(4.6e+02)		(4.1e+02)	
f_{24}	2.6e+02	3.9e+02	+	2.7e+02	+	2.6e+02	·
	(1.6e+01)	(4.0e+00)		(1.0e+01)		(1.1e+01)	
f_{25}	3.1e+02	4.3e+02	+	3.0e+02	−	3.0e+02	−
	(8.7e+00)	(4.1e+00)		(1.2e+01)		(9.3e+00)	
f_{26}	3.1e+02	3.4e+02	·	3.4e+02	+	3.3e+02	·
	(6.7e+01)	(6.6e+01)		(5.4e+01)		(5.0e+01)	
f_{27}	9.2e+02	2.1e+03	+	9.3e+02	·	8.0e+02	−
	(1.1e+02)	(4.3e+01)		(9.3e+01)		(8.2e+01)	
f_{28}	7.3e+02	2.6e+03	+	1.1e+03	−	7.5e+02	−
	(9.0e+02)	(1.7e+02)		(1.3e+03)		(9.7e+02)	
Summary (+/·/−)		22/4/2		11/6/11		4/16/8	

Table 213: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	3.4e−02	2.0e−02	−	5.4e+00	+	3.2e−03	−
	(7.0e−03)	(4.7e−03)		(2.3e+00)		(4.6e−04)	
f_2	3.9e+08	4.1e+08	·	2.5e+08	−	3.4e+08	−
	(4.4e+07)	(4.6e+07)		(5.1e+07)		(4.5e+07)	
f_3	1.3e+10	9.5e+09	−	3.7e+10	+	1.6e+10	+
	(1.4e+09)	(1.3e+09)		(1.0e+10)		(1.5e+09)	
f_4	1.1e+05	1.1e+05	·	8.2e+04	−	1.0e+05	·
	(1.1e+04)	(1.1e+04)		(9.3e+03)		(8.4e+03)	
f_5	2.5e−01	1.9e−01	−	7.8e+00	+	4.7e−02	−
	(4.1e−02)	(2.4e−02)		(1.8e+00)		(4.2e−03)	
f_6	4.7e+01	4.7e+01	+	4.9e+01	+	4.6e+01	−
	(1.6e−01)	(2.0e−01)		(1.0e+00)		(1.2e−01)	
f_7	1.0e+02	9.5e+01	−	1.4e+02	+	1.0e+02	+
	(5.4e+00)	(5.3e+00)		(1.5e+01)		(5.5e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.5e−02)	(3.7e−02)		(3.3e−02)		(4.0e−02)	
f_9	7.3e+01	7.3e+01	·	7.2e+01	·	7.3e+01	·
	(1.6e+00)	(1.5e+00)		(1.8e+00)		(1.4e+00)	
f_{10}	7.0e+02	3.7e+02	−	2.6e+02	−	7.8e+02	·
	(1.0e+02)	(5.6e+01)		(8.1e+01)		(7.1e+01)	
f_{11}	3.4e+02	3.0e+02	−	7.2e+01	−	3.4e+02	·
	(1.1e+01)	(1.6e+01)		(1.3e+01)		(1.2e+01)	
f_{12}	4.2e+02	4.1e+02	·	4.7e+02	+	4.2e+02	·
	(1.6e+01)	(1.3e+01)		(2.4e+01)		(1.6e+01)	
f_{13}	4.2e+02	4.1e+02	−	4.7e+02	+	4.3e+02	·
	(1.6e+01)	(1.3e+01)		(2.2e+01)		(1.5e+01)	
f_{14}	1.2e+04	1.1e+04	−	1.5e+03	−	1.2e+04	+
	(3.7e+02)	(4.0e+02)		(3.4e+02)		(3.3e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.0e+02)	(3.7e+02)		(3.5e+02)		(3.7e+02)	
f_{16}	3.4e+00	3.3e+00	·	3.2e+00	·	3.3e+00	·
	(2.7e−01)	(2.8e−01)		(3.6e−01)		(2.5e−01)	
f_{17}	4.1e+02	3.7e+02	−	1.6e+02	−	4.1e+02	·
	(1.4e+01)	(1.4e+01)		(1.9e+01)		(1.1e+01)	
f_{18}	4.7e+02	4.6e+02	·	5.2e+02	+	4.7e+02	·
	(1.2e+01)	(1.2e+01)		(1.9e+01)		(1.3e+01)	
f_{19}	3.5e+01	3.4e+01	·	2.5e+01	−	3.4e+01	·
	(1.5e+00)	(1.2e+00)		(4.6e+00)		(1.6e+00)	
f_{20}	2.3e+01	2.3e+01	·	2.3e+01	+	2.2e+01	·
	(2.0e−01)	(2.1e−01)		(2.2e−01)		(2.2e−01)	
f_{21}	2.0e+02	2.0e+02	−	7.2e+02	+	2.2e+02	−
	(1.6e+00)	(4.3e−01)		(4.5e+02)		(1.1e+02)	
f_{22}	1.2e+04	1.1e+04	−	1.9e+03	−	1.2e+04	·
	(3.7e+02)	(5.6e+02)		(4.1e+02)		(2.9e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.3e+02)	(4.1e+02)		(4.2e+02)		(3.4e+02)	
f_{24}	3.4e+02	3.4e+02	·	3.6e+02	+	3.3e+02	·
	(6.0e+00)	(8.1e+00)		(1.6e+01)		(4.6e+00)	
f_{25}	4.0e+02	4.0e+02	·	3.6e+02	−	4.1e+02	+
	(5.7e+00)	(7.2e+00)		(2.0e+01)		(5.0e+00)	
f_{26}	3.6e+02	3.5e+02	·	4.4e+02	+	4.4e+02	+
	(7.7e+01)	(8.1e+01)		(9.3e+01)		(3.4e+01)	
f_{27}	2.1e+03	2.1e+03	·	2.1e+03	·	2.0e+03	·
	(3.7e+01)	(3.3e+01)		(1.3e+02)		(3.5e+01)	
f_{28}	4.0e+02	4.0e+02	−	9.4e+02	+	4.0e+02	−
	(1.6e−01)	(1.1e−01)		(1.2e+03)		(2.8e−02)	
Summary (+/·/−)		1/15/12		13/6/9		5/17/6	

Table 214: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.7}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	3.1e+02	0.0e+00	−	3.6e−05	−	2.8e−01	−
	(1.8e+02)	(0.0e+00)		(2.1e−05)		(1.7e−01)	
f_2	5.8e+06	1.9e+08	+	1.5e+08	+	2.2e+08	+
	(1.9e+06)	(3.1e+07)		(4.2e+07)		(4.5e+07)	
f_3	6.5e+08	9.9e+05	−	1.6e+10	+	4.0e+10	+
	(5.3e+08)	(2.5e+06)		(7.1e+09)		(7.3e+09)	
f_4	2.2e+04	1.0e+05	+	6.3e+04	+	6.6e+04	+
	(3.1e+03)	(1.0e+04)		(8.2e+03)		(6.8e+03)	
f_5	3.1e+02	0.0e+00	−	4.2e−03	−	1.1e+00	−
	(1.1e+02)	(0.0e+00)		(1.9e−03)		(4.6e−01)	
f_6	1.6e+02	4.8e+01	−	4.7e+01	−	4.7e+01	−
	(4.0e+01)	(3.9e−01)		(8.1e+00)		(1.2e+00)	
f_7	6.5e+00	5.6e+00	·	1.1e+02	+	1.4e+02	+
	(5.4e+00)	(2.8e+00)		(1.8e+01)		(1.3e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.8e−02)	(3.3e−02)		(4.1e−02)		(3.1e−02)	
f_9	5.9e+01	7.2e+01	+	6.9e+01	+	7.2e+01	+
	(1.6e+01)	(1.7e+00)		(6.0e+00)		(1.6e+00)	
f_{10}	2.1e+02	3.0e+00	−	1.9e+01	−	5.8e+02	+
	(8.4e+01)	(1.8e+00)		(7.7e+00)		(1.6e+02)	
f_{11}	2.8e+02	1.7e+02	−	8.1e+01	−	3.9e+02	+
	(1.3e+01)	(1.4e+01)		(1.6e+01)		(1.8e+01)	
f_{12}	3.4e+02	3.4e+02	·	4.3e+02	+	4.6e+02	+
	(1.6e+01)	(1.7e+01)		(2.4e+01)		(2.3e+01)	
f_{13}	3.4e+02	3.4e+02	·	4.4e+02	+	4.6e+02	+
	(1.2e+01)	(1.2e+01)		(1.9e+01)		(2.2e+01)	
f_{14}	1.2e+04	9.7e+03	−	1.8e+03	−	1.2e+04	+
	(3.8e+02)	(4.7e+02)		(3.8e+02)		(4.0e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	+	1.4e+04	+
	(3.6e+02)	(3.2e+02)		(4.2e+02)		(3.6e+02)	
f_{16}	3.4e+00	3.4e+00	·	3.3e+00	·	3.3e+00	·
	(3.0e−01)	(2.3e−01)		(3.2e−01)		(2.6e−01)	
f_{17}	3.3e+02	2.9e+02	−	1.4e+02	−	4.9e+02	+
	(1.2e+01)	(1.3e+01)		(2.0e+01)		(2.1e+01)	
f_{18}	3.7e+02	3.8e+02	·	4.8e+02	+	5.3e+02	+
	(1.5e+01)	(1.1e+01)		(2.3e+01)		(2.5e+01)	
f_{19}	3.9e+01	2.6e+01	−	1.1e+01	−	4.0e+01	+
	(3.3e+01)	(1.0e+00)		(3.5e+00)		(2.7e+00)	
f_{20}	2.1e+01	2.2e+01	+	2.3e+01	+	2.3e+01	+
	(2.8e−01)	(2.3e−01)		(2.4e−01)		(2.5e−01)	
f_{21}	1.4e+03	4.1e+02	−	7.6e+02	−	8.0e+02	−
	(5.0e+02)	(3.9e+02)		(4.3e+02)		(4.2e+02)	
f_{22}	1.1e+04	8.9e+03	−	2.2e+03	−	1.2e+04	+
	(3.7e+02)	(4.2e+02)		(4.1e+02)		(4.6e+02)	
f_{23}	1.3e+04	1.4e+04	+	1.4e+04	+	1.4e+04	+
	(3.6e+02)	(3.4e+02)		(4.9e+02)		(4.2e+02)	
f_{24}	2.4e+02	2.1e+02	−	3.1e+02	+	3.5e+02	+
	(1.4e+01)	(1.5e+01)		(1.9e+01)		(1.4e+01)	
f_{25}	2.9e+02	2.8e+02	−	3.1e+02	+	3.6e+02	+
	(8.4e+00)	(1.0e+01)		(1.1e+01)		(2.3e+01)	
f_{26}	2.9e+02	2.4e+02	·	4.3e+02	+	4.4e+02	+
	(5.6e+01)	(4.6e+01)		(6.9e+01)		(8.8e+01)	
f_{27}	7.1e+02	7.4e+02	·	1.6e+03	+	2.0e+03	+
	(1.0e+02)	(2.1e+02)		(2.7e+02)		(1.2e+02)	
f_{28}	1.1e+03	4.0e+02	−	9.0e+02	−	1.2e+03	−
	(9.1e+02)	(5.6e−11)		(1.2e+03)		(1.4e+03)	
Summary (+/·/−)		5/9/14		15/2/11		21/2/5	

Table 215: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	8.5e−02	7.6e−02	·	6.8e−03	−	4.5e+00	+
	(2.2e−02)	(1.9e−02)		(3.9e−03)		(4.6e−01)	
f_2	1.1e+08	9.9e+07	·	1.4e+07	−	1.6e+08	+
	(2.0e+07)	(1.7e+07)		(5.4e+06)		(1.8e+07)	
f_3	4.9e+09	4.6e+09	·	2.9e+09	−	2.7e+10	+
	(1.2e+09)	(9.7e+08)		(1.8e+09)		(2.1e+09)	
f_4	9.3e+04	9.3e+04	·	7.4e+04	−	9.3e+04	·
	(1.1e+04)	(1.1e+04)		(1.1e+04)		(7.7e+03)	
f_5	2.9e−01	2.9e−01	·	1.7e−01	−	3.3e+00	+
	(4.5e−02)	(5.5e−02)		(9.3e−02)		(2.6e−01)	
f_6	4.7e+01	4.7e+01	·	5.0e+01	·	4.9e+01	+
	(3.4e−01)	(3.3e−01)		(1.4e+01)		(3.7e−01)	
f_7	7.0e+01	7.0e+01	·	7.4e+01	·	1.1e+02	+
	(7.3e+00)	(5.6e+00)		(1.7e+01)		(5.1e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.4e−02)	(3.3e−02)		(3.0e−02)		(4.0e−02)	
f_9	7.3e+01	7.3e+01	·	3.4e+01	−	7.3e+01	·
	(1.3e+00)	(1.3e+00)		(5.5e+00)		(1.4e+00)	
f_{10}	1.7e+01	1.6e+01	·	4.5e+00	−	3.5e+02	+
	(4.0e+00)	(3.4e+00)		(2.3e+00)		(2.9e+01)	
f_{11}	3.4e+02	3.4e+02	·	1.4e+02	−	4.0e+02	+
	(1.4e+01)	(1.5e+01)		(3.5e+01)		(1.5e+01)	
f_{12}	3.8e+02	3.9e+02	·	1.4e+02	−	4.4e+02	+
	(1.5e+01)	(1.3e+01)		(5.8e+01)		(1.5e+01)	
f_{13}	3.8e+02	3.8e+02	·	3.7e+02	·	4.5e+02	+
	(1.5e+01)	(1.4e+01)		(6.3e+01)		(1.6e+01)	
f_{14}	1.2e+04	1.2e+04	·	3.7e+03	−	1.3e+04	+
	(4.8e+02)	(5.1e+02)		(7.5e+02)		(3.3e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.6e+02)	(3.5e+02)		(6.1e+02)		(4.0e+02)	
f_{16}	3.3e+00	3.4e+00	·	3.3e+00	·	3.3e+00	·
	(3.0e−01)	(3.0e−01)		(2.4e−01)		(3.1e−01)	
f_{17}	4.0e+02	4.0e+02	·	2.4e+02	−	4.9e+02	+
	(1.6e+01)	(1.8e+01)		(3.4e+01)		(1.8e+01)	
f_{18}	4.4e+02	4.4e+02	·	4.7e+02	+	5.1e+02	+
	(1.5e+01)	(1.4e+01)		(2.7e+01)		(1.3e+01)	
f_{19}	3.3e+01	3.3e+01	·	1.3e+01	−	4.0e+01	+
	(1.4e+00)	(1.5e+00)		(2.9e+00)		(1.5e+00)	
f_{20}	2.3e+01	2.3e+01	·	2.3e+01	·	2.3e+01	·
	(2.2e−01)	(2.2e−01)		(3.2e−01)		(2.2e−01)	
f_{21}	2.1e+02	2.1e+02	·	8.1e+02	·	2.4e+02	+
	(8.1e−01)	(7.0e−01)		(4.4e+02)		(2.2e+00)	
f_{22}	1.2e+04	1.2e+04	·	4.1e+03	−	1.3e+04	+
	(4.6e+02)	(4.1e+02)		(7.2e+02)		(4.0e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(2.9e+02)	(3.4e+02)		(8.1e+02)		(3.5e+02)	
f_{24}	2.8e+02	2.8e+02	·	2.8e+02	·	3.4e+02	+
	(1.5e+01)	(1.2e+01)		(9.0e+00)		(4.3e+00)	
f_{25}	3.8e+02	3.8e+02	·	3.1e+02	−	4.2e+02	+
	(2.1e+01)	(1.9e+01)		(1.2e+01)		(5.1e+00)	
f_{26}	2.7e+02	2.4e+02	·	3.6e+02	·	4.4e+02	+
	(1.1e+02)	(8.1e+01)		(6.5e+01)		(4.8e+01)	
f_{27}	1.8e+03	1.9e+03	·	1.1e+03	−	2.0e+03	+
	(1.5e+02)	(1.7e+02)		(1.0e+02)		(5.5e+01)	
f_{28}	4.0e+02	4.0e+02	·	1.1e+03	−	4.2e+02	+
	(2.9e−01)	(2.7e−01)		(1.3e+03)		(8.4e−01)	
Summary (+/·/−)		0/28/0		1/11/16		21/7/0	

Table 216: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	7.8e+03	9.8e+02	−	1.7e+03	−	1.1e+04	+
	(1.0e+03)	(1.7e+02)		(6.5e+02)		(7.6e+02)	
f_2	4.1e+08	2.7e+08	−	1.8e+07	−	4.3e+08	·
	(5.0e+07)	(3.3e+07)		(5.4e+06)		(5.3e+07)	
f_3	7.9e+10	5.5e+10	−	7.4e+09	−	8.6e+10	+
	(8.1e+09)	(4.7e+09)		(2.8e+09)		(5.8e+09)	
f_4	1.2e+05	1.1e+05	−	8.9e+04	−	1.2e+05	·
	(9.2e+03)	(9.7e+03)		(9.8e+03)		(1.0e+04)	
f_5	5.5e+02	1.9e+02	−	2.1e+02	−	5.0e+02	−
	(6.0e+01)	(1.8e+01)		(1.6e+02)		(3.2e+01)	
f_6	6.3e+02	1.6e+02	−	1.7e+02	−	9.2e+02	+
	(7.4e+01)	(1.7e+01)		(6.7e+01)		(7.8e+01)	
f_7	1.8e+02	1.6e+02	−	8.0e+01	−	1.8e+02	·
	(9.7e+00)	(7.0e+00)		(1.7e+01)		(8.5e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.2e−02)	(5.1e−02)		(3.8e−02)		(3.9e−02)	
f_9	7.3e+01	7.3e+01	·	4.8e+01	−	7.3e+01	·
	(1.5e+00)	(1.4e+00)		(7.1e+00)		(1.2e+00)	
f_{10}	2.2e+03	7.4e+02	−	3.9e+02	−	2.7e+03	+
	(2.9e+02)	(1.3e+02)		(1.6e+02)		(2.2e+02)	
f_{11}	5.2e+02	4.1e+02	−	1.7e+02	−	5.5e+02	+
	(1.9e+01)	(1.8e+01)		(2.8e+01)		(2.2e+01)	
f_{12}	5.9e+02	4.5e+02	−	2.9e+02	−	6.4e+02	+
	(2.6e+01)	(2.0e+01)		(4.8e+01)		(2.1e+01)	
f_{13}	5.8e+02	4.5e+02	−	3.5e+02	−	6.3e+02	+
	(2.4e+01)	(1.6e+01)		(6.0e+01)		(2.5e+01)	
f_{14}	1.3e+04	1.2e+04	−	3.1e+03	−	1.3e+04	·
	(3.4e+02)	(3.0e+02)		(5.5e+02)		(3.8e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.6e+02)	(3.5e+02)		(4.3e+02)		(3.0e+02)	
f_{16}	3.4e+00	3.2e+00	·	3.3e+00	·	3.3e+00	·
	(2.4e−01)	(2.8e−01)		(3.2e−01)		(2.9e−01)	
f_{17}	9.8e+02	5.2e+02	−	4.1e+02	−	1.2e+03	+
	(5.8e+01)	(2.1e+01)		(7.1e+01)		(5.9e+01)	
f_{18}	9.7e+02	5.3e+02	−	5.2e+02	−	1.3e+03	+
	(6.2e+01)	(2.3e+01)		(5.9e+01)		(6.6e+01)	
f_{19}	2.1e+03	6.2e+01	−	2.1e+02	−	4.3e+03	+
	(1.0e+03)	(5.9e+00)		(3.5e+02)		(1.1e+03)	
f_{20}	2.3e+01	2.3e+01	·	2.3e+01	−	2.3e+01	+
	(1.9e−01)	(1.9e−01)		(4.0e−01)		(1.9e−01)	
f_{21}	1.6e+03	7.5e+02	−	1.3e+03	−	1.8e+03	+
	(7.4e+01)	(4.4e+01)		(4.0e+02)		(6.2e+01)	
f_{22}	1.4e+04	1.3e+04	−	3.2e+03	−	1.4e+04	·
	(2.5e+02)	(4.1e+02)		(5.9e+02)		(4.3e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.5e+02)	(3.1e+02)		(5.3e+02)		(4.3e+02)	
f_{24}	3.9e+02	3.7e+02	−	3.0e+02	−	3.9e+02	+
	(5.2e+00)	(8.2e+00)		(1.1e+01)		(5.0e+00)	
f_{25}	4.3e+02	4.3e+02	−	3.3e+02	−	4.4e+02	+
	(4.9e+00)	(5.3e+00)		(1.4e+01)		(5.0e+00)	
f_{26}	3.0e+02	2.8e+02	·	3.3e+02	·	4.3e+02	+
	(8.3e+01)	(8.0e+01)		(1.0e+02)		(3.5e+01)	
f_{27}	2.2e+03	2.2e+03	·	1.4e+03	−	2.2e+03	+
	(4.4e+01)	(5.0e+01)		(1.3e+02)		(3.7e+01)	
f_{28}	1.3e+03	6.6e+02	−	1.1e+03	−	1.5e+03	+
	(8.3e+01)	(2.3e+01)		(1.1e+03)		(7.5e+01)	
Summary (+/·/−)		0/8/20		0/5/23		17/10/1	

Table 217: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	7.5e+03	4.6e+04	+	7.9e+03	·	7.2e+03	·
	(2.6e+03)	(4.1e+03)		(2.2e+03)		(2.1e+03)	
f_2	6.5e+07	8.0e+08	+	5.6e+07	·	2.8e+07	−
	(4.2e+07)	(1.1e+08)		(3.5e+07)		(2.7e+07)	
f_3	1.8e+08	1.8e+11	+	3.8e+08	·	1.8e+08	·
	(2.2e+08)	(2.4e+10)		(1.0e+09)		(1.6e+08)	
f_4	2.6e+02	1.3e+05	+	2.6e+02	·	4.5e+02	+
	(1.0e+02)	(1.0e+04)		(1.5e+02)		(1.6e+02)	
f_5	1.6e+03	9.9e+03	+	1.7e+03	·	1.6e+03	·
	(7.2e+02)	(1.4e+03)		(6.7e+02)		(6.6e+02)	
f_6	5.4e+02	3.5e+03	+	5.5e+02	·	4.9e+02	·
	(1.6e+02)	(4.6e+02)		(1.7e+02)		(1.2e+02)	
f_7	1.2e+02	2.9e+02	+	1.2e+02	·	1.0e+02	·
	(2.2e+01)	(2.4e+01)		(1.7e+01)		(2.8e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.5e−02)	(3.3e−02)		(3.6e−02)		(3.4e−02)	
f_9	4.2e+01	7.3e+01	+	4.2e+01	·	3.5e+01	−
	(3.5e+00)	(1.6e+00)		(4.8e+00)		(3.0e+00)	
f_{10}	1.6e+03	6.6e+03	+	1.5e+03	·	1.4e+03	·
	(3.8e+02)	(5.9e+02)		(4.4e+02)		(3.5e+02)	
f_{11}	3.8e+02	9.5e+02	+	3.7e+02	·	3.1e+02	−
	(7.4e+01)	(4.9e+01)		(6.2e+01)		(5.5e+01)	
f_{12}	4.0e+02	9.7e+02	+	4.0e+02	·	3.3e+02	−
	(6.4e+01)	(5.4e+01)		(7.9e+01)		(6.4e+01)	
f_{13}	5.3e+02	9.8e+02	+	5.3e+02	·	4.8e+02	·
	(8.9e+01)	(5.1e+01)		(8.9e+01)		(8.3e+01)	
f_{14}	5.7e+03	1.2e+04	+	5.6e+03	·	8.8e+03	·
	(8.6e+02)	(3.8e+02)		(8.1e+02)		(4.1e+03)	
f_{15}	7.3e+03	1.4e+04	+	7.0e+03	·	1.4e+04	+
	(1.3e+03)	(3.2e+02)		(8.7e+02)		(6.8e+02)	
f_{16}	3.4e+00	3.3e+00	·	3.4e+00	·	3.3e+00	·
	(2.7e−01)	(2.8e−01)		(2.3e−01)		(3.2e−01)	
f_{17}	6.3e+02	2.2e+03	+	6.0e+02	·	4.6e+02	−
	(1.3e+02)	(1.2e+02)		(1.2e+02)		(8.3e+01)	
f_{18}	6.2e+02	2.2e+03	+	6.1e+02	·	7.4e+02	+
	(1.1e+02)	(1.5e+02)		(1.1e+02)		(8.5e+01)	
f_{19}	3.5e+03	2.3e+05	+	3.7e+03	·	1.9e+03	·
	(2.5e+03)	(6.0e+04)		(3.5e+03)		(1.7e+03)	
f_{20}	2.2e+01	2.4e+01	+	2.2e+01	·	2.2e+01	·
	(1.1e+00)	(2.3e−01)		(9.1e−01)		(7.9e−01)	
f_{21}	2.4e+03	5.4e+03	+	2.4e+03	·	2.3e+03	·
	(4.9e+02)	(4.4e+02)		(5.4e+02)		(5.1e+02)	
f_{22}	7.0e+03	1.3e+04	+	7.0e+03	·	7.2e+03	−
	(8.6e+02)	(3.8e+02)		(1.3e+03)		(3.1e+03)	
f_{23}	7.7e+03	1.5e+04	+	8.1e+03	·	1.3e+04	+
	(1.1e+03)	(4.4e+02)		(1.1e+03)		(1.8e+03)	
f_{24}	3.4e+02	4.2e+02	+	3.4e+02	·	3.3e+02	·
	(1.4e+01)	(5.6e+00)		(1.2e+01)		(1.4e+01)	
f_{25}	3.8e+02	4.6e+02	+	3.8e+02	·	3.7e+02	·
	(1.2e+01)	(7.4e+00)		(1.3e+01)		(1.5e+01)	
f_{26}	4.1e+02	3.7e+02	−	4.1e+02	·	4.0e+02	·
	(3.1e+01)	(4.0e+01)		(3.1e+01)		(3.1e+01)	
f_{27}	1.5e+03	2.3e+03	+	1.5e+03	·	1.4e+03	−
	(1.2e+02)	(3.7e+01)		(1.2e+02)		(1.1e+02)	
f_{28}	3.0e+03	6.3e+03	+	2.8e+03	·	3.1e+03	·
	(1.3e+03)	(3.8e+02)		(1.3e+03)		(1.3e+03)	
Summary (+/·/−)		25/2/1		0/28/0		4/17/7	

Table 218: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	6.0e−08	4.2e+03	+	0.0e+00	−	7.5e−07	+
	(4.7e−08)	(1.4e+03)		(0.0e+00)		(7.2e−07)	
f_2	1.6e+07	1.7e+08	+	6.4e+06	−	1.9e+07	·
	(4.2e+06)	(5.5e+07)		(2.1e+06)		(5.0e+06)	
f_3	5.6e+09	5.4e+10	+	8.0e+08	−	1.0e+10	+
	(3.6e+09)	(1.6e+10)		(7.3e+08)		(5.8e+09)	
f_4	4.6e+04	6.7e+04	+	3.7e+04	−	4.3e+04	·
	(6.7e+03)	(9.9e+03)		(6.1e+03)		(6.5e+03)	
f_5	4.8e−05	2.5e+03	+	9.6e−08	−	1.9e−04	+
	(4.2e−05)	(1.0e+03)		(8.2e−08)		(1.2e−04)	
f_6	4.4e+01	2.9e+02	+	4.4e+01	−	4.4e+01	·
	(8.0e−01)	(8.1e+01)		(1.3e+00)		(1.4e+00)	
f_7	9.1e+01	1.4e+02	+	8.2e+01	·	1.0e+02	·
	(2.6e+01)	(1.9e+01)		(2.9e+01)		(2.6e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.8e−02)	(3.3e−02)		(3.7e−02)		(3.4e−02)	
f_9	3.9e+01	5.9e+01	+	2.7e+01	−	5.9e+01	+
	(1.5e+01)	(3.4e+00)		(5.2e+00)		(1.5e+01)	
f_{10}	1.0e+00	1.2e+03	+	2.9e−02	−	1.4e+00	+
	(1.7e−01)	(3.5e+02)		(1.5e−02)		(2.7e−01)	
f_{11}	3.9e+02	2.5e+02	−	1.6e+02	−	4.1e+02	·
	(2.3e+01)	(4.1e+01)		(4.2e+01)		(2.6e+01)	
f_{12}	4.4e+02	4.2e+02	·	1.4e+02	−	4.3e+02	·
	(2.9e+01)	(4.1e+01)		(3.7e+01)		(2.5e+01)	
f_{13}	4.4e+02	4.3e+02	·	3.8e+02	−	4.4e+02	·
	(3.2e+01)	(4.0e+01)		(6.4e+01)		(2.4e+01)	
f_{14}	1.3e+04	1.6e+03	−	3.5e+03	−	1.3e+04	+
	(4.9e+02)	(4.1e+02)		(7.7e+02)		(4.1e+02)	
f_{15}	1.4e+04	1.2e+04	−	1.2e+04	−	1.4e+04	·
	(2.9e+02)	(5.5e+02)		(2.0e+03)		(4.1e+02)	
f_{16}	3.4e+00	3.2e+00	·	3.4e+00	·	3.3e+00	·
	(2.5e−01)	(2.8e−01)		(2.4e−01)		(2.7e−01)	
f_{17}	4.6e+02	4.7e+02	·	2.2e+02	−	4.7e+02	·
	(2.2e+01)	(5.9e+01)		(3.9e+01)		(2.4e+01)	
f_{18}	4.8e+02	5.7e+02	+	4.6e+02	·	4.9e+02	·
	(2.9e+01)	(5.5e+01)		(2.7e+01)		(2.9e+01)	
f_{19}	3.5e+01	8.0e+03	+	1.0e+01	−	3.5e+01	·
	(2.1e+00)	(1.3e+04)		(3.1e+00)		(1.9e+00)	
f_{20}	2.3e+01	2.3e+01	·	2.2e+01	·	2.3e+01	·
	(4.4e−01)	(3.8e−01)		(3.2e−01)		(4.0e−01)	
f_{21}	7.3e+02	2.3e+03	+	7.8e+02	+	7.9e+02	+
	(4.4e+02)	(5.5e+02)		(4.1e+02)		(4.3e+02)	
f_{22}	1.3e+04	2.7e+03	−	4.2e+03	−	1.3e+04	+
	(6.2e+02)	(6.5e+02)		(7.3e+02)		(5.5e+02)	
f_{23}	1.4e+04	1.3e+04	−	1.2e+04	−	1.4e+04	·
	(4.0e+02)	(5.9e+02)		(2.6e+03)		(5.8e+02)	
f_{24}	2.8e+02	3.5e+02	+	2.8e+02	·	3.0e+02	·
	(1.3e+01)	(1.1e+01)		(1.4e+01)		(2.0e+01)	
f_{25}	3.0e+02	3.8e+02	+	3.1e+02	·	3.1e+02	+
	(1.0e+01)	(9.1e+00)		(1.2e+01)		(1.2e+01)	
f_{26}	3.6e+02	2.7e+02	·	3.5e+02	·	4.0e+02	+
	(5.2e+01)	(9.2e+01)		(4.6e+01)		(5.7e+01)	
f_{27}	1.1e+03	1.8e+03	+	1.0e+03	·	1.3e+03	+
	(1.2e+02)	(7.9e+01)		(9.2e+01)		(2.3e+02)	
f_{28}	1.0e+03	2.0e+03	+	1.5e+03	−	9.7e+02	+
	(1.3e+03)	(7.9e+02)		(1.5e+03)		(1.2e+03)	
Summary (+/·/−)		16/7/5		1/9/18		12/16/0	

Table 219: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.5e+02	3.8e+03	+	0.0e+00	−	5.8e−01	−
	(6.6e+01)	(1.2e+03)		(0.0e+00)		(1.9e+00)	
f_2	2.2e+06	1.7e+08	+	7.1e+06	+	2.4e+06	·
	(6.4e+05)	(4.8e+07)		(2.4e+06)		(6.0e+05)	
f_3	1.1e+07	6.0e+10	+	9.4e+08	+	1.2e+07	·
	(1.9e+07)	(1.6e+10)		(1.1e+09)		(3.2e+07)	
f_4	2.6e+04	6.8e+04	+	3.7e+04	+	2.2e+04	−
	(3.5e+03)	(1.4e+04)		(6.0e+03)		(2.2e+03)	
f_5	1.8e+02	2.4e+03	+	1.0e−07	−	4.1e+01	−
	(5.6e+01)	(1.0e+03)		(2.2e−07)		(1.9e+01)	
f_6	5.7e+01	3.1e+02	+	4.5e+01	−	4.8e+01	−
	(9.1e+00)	(8.6e+01)		(7.3e+00)		(1.9e+00)	
f_7	5.8e−01	1.5e+02	+	7.9e+01	+	1.3e+00	·
	(7.6e−01)	(2.4e+01)		(3.1e+01)		(1.3e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.6e−02)	(3.9e−02)		(3.3e−02)		(3.0e−02)	
f_9	6.4e+01	5.9e+01	−	2.5e+01	−	2.6e+01	−
	(6.0e+00)	(2.8e+00)		(5.1e+00)		(1.9e+01)	
f_{10}	4.6e+01	1.4e+03	+	2.6e−02	−	1.5e+01	−
	(1.3e+01)	(4.6e+02)		(1.5e−02)		(6.1e+00)	
f_{11}	3.2e+02	2.6e+02	−	1.7e+02	−	3.0e+02	−
	(1.4e+01)	(6.1e+01)		(4.4e+01)		(1.3e+01)	
f_{12}	3.3e+02	4.2e+02	+	1.5e+02	−	3.2e+02	−
	(1.1e+01)	(3.4e+01)		(3.7e+01)		(1.3e+01)	
f_{13}	3.4e+02	4.4e+02	+	3.7e+02	+	3.2e+02	−
	(1.4e+01)	(3.2e+01)		(6.5e+01)		(1.3e+01)	
f_{14}	1.3e+04	1.7e+03	−	3.7e+03	−	1.3e+04	·
	(3.4e+02)	(3.9e+02)		(7.5e+02)		(2.9e+02)	
f_{15}	1.4e+04	1.2e+04	−	1.2e+04	−	1.4e+04	·
	(3.9e+02)	(6.9e+02)		(2.1e+03)		(3.7e+02)	
f_{16}	3.3e+00	3.1e+00	−	3.3e+00	·	3.3e+00	·
	(2.4e−01)	(2.8e−01)		(2.7e−01)		(3.0e−01)	
f_{17}	3.5e+02	4.8e+02	+	2.3e+02	−	3.5e+02	·
	(1.2e+01)	(6.7e+01)		(4.6e+01)		(8.9e+00)	
f_{18}	3.7e+02	5.8e+02	+	4.7e+02	+	3.6e+02	−
	(8.8e+00)	(7.0e+01)		(3.4e+01)		(1.0e+01)	
f_{19}	2.9e+01	5.6e+03	+	9.4e+00	−	2.5e+01	−
	(3.6e+00)	(6.2e+03)		(2.4e+00)		(1.8e+00)	
f_{20}	2.2e+01	2.3e+01	+	2.2e+01	+	2.1e+01	−
	(2.4e−01)	(4.1e−01)		(3.7e−01)		(2.1e−01)	
f_{21}	6.2e+02	2.3e+03	+	8.1e+02	·	7.5e+02	·
	(3.6e+02)	(4.5e+02)		(4.1e+02)		(3.4e+02)	
f_{22}	1.3e+04	3.0e+03	−	4.4e+03	−	1.2e+04	−
	(3.4e+02)	(7.4e+02)		(7.3e+02)		(3.2e+02)	
f_{23}	1.4e+04	1.3e+04	−	1.2e+04	−	1.3e+04	−
	(3.8e+02)	(6.4e+02)		(2.6e+03)		(4.2e+02)	
f_{24}	2.0e+02	3.5e+02	+	2.8e+02	+	2.0e+02	−
	(2.8e+00)	(1.1e+01)		(1.1e+01)		(1.5e+00)	
f_{25}	2.9e+02	3.8e+02	+	3.1e+02	+	2.8e+02	−
	(1.9e+01)	(9.5e+00)		(8.9e+00)		(5.6e+00)	
f_{26}	2.0e+02	2.9e+02	+	3.7e+02	+	3.0e+02	+
	(5.5e−02)	(1.1e+02)		(2.5e+01)		(3.4e+00)	
f_{27}	3.5e+02	1.8e+03	+	1.0e+03	+	3.3e+02	−
	(2.6e+01)	(8.3e+01)		(1.2e+02)		(3.0e+01)	
f_{28}	4.4e+02	2.0e+03	+	1.4e+03	·	4.1e+02	−
	(1.5e+01)	(9.1e+02)		(1.5e+03)		(4.5e+00)	
Summary (+/·/−)		20/1/7		11/4/13		1/9/18	

Table 220: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.1e+03	2.4e+04	+	2.3e−01	−	5.3e+00	−
	(5.5e+02)	(2.1e+03)		(1.4e+00)		(1.5e+01)	
f_2	8.0e+06	4.9e+08	+	1.5e+06	−	1.1e+06	−
	(8.0e+06)	(6.8e+07)		(4.4e+05)		(3.3e+05)	
f_3	3.8e+09	1.1e+11	+	1.8e+08	−	1.6e+07	−
	(1.9e+09)	(9.5e+09)		(2.5e+08)		(2.9e+07)	
f_4	3.3e+02	1.1e+05	+	8.7e+03	+	3.5e+03	+
	(1.2e+02)	(9.2e+03)		(2.5e+03)		(9.2e+02)	
f_5	5.7e+02	4.1e+03	+	4.1e+01	−	1.4e+02	−
	(2.6e+02)	(5.6e+02)		(4.2e+01)		(7.7e+01)	
f_6	2.0e+02	1.6e+03	+	6.8e+01	−	8.3e+01	−
	(5.4e+01)	(1.6e+02)		(3.7e+01)		(3.2e+01)	
f_7	5.8e+01	2.0e+02	+	8.5e+01	+	6.8e+01	·
	(1.9e+01)	(1.1e+01)		(2.5e+01)		(2.8e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(2.7e−02)	(4.3e−02)		(4.6e−02)		(3.1e−02)	
f_9	2.7e+01	7.2e+01	+	3.0e+01	+	2.2e+01	−
	(3.1e+00)	(1.7e+00)		(3.5e+00)		(3.0e+00)	
f_{10}	4.3e+02	4.2e+03	+	2.8e+01	−	1.0e+02	−
	(1.6e+02)	(3.6e+02)		(3.3e+01)		(6.5e+01)	
f_{11}	1.5e+02	6.7e+02	+	2.1e+02	+	1.4e+02	·
	(3.2e+01)	(3.0e+01)		(4.9e+01)		(8.6e+01)	
f_{12}	1.5e+02	7.4e+02	+	1.9e+02	+	4.1e+02	+
	(5.2e+01)	(3.4e+01)		(3.9e+01)		(3.1e+01)	
f_{13}	3.7e+02	7.3e+02	+	3.6e+02	·	4.0e+02	·
	(6.6e+01)	(3.5e+01)		(7.4e+01)		(2.7e+01)	
f_{14}	1.3e+04	1.2e+04	−	4.2e+03	−	1.3e+04	·
	(5.5e+02)	(3.8e+02)		(6.5e+02)		(5.1e+02)	
f_{15}	1.4e+04	1.4e+04	·	9.4e+03	−	1.4e+04	·
	(5.1e+02)	(3.2e+02)		(3.1e+03)		(4.5e+02)	
f_{16}	3.3e+00	3.4e+00	·	3.2e+00	·	3.3e+00	·
	(3.2e−01)	(2.4e−01)		(2.7e−01)		(2.6e−01)	
f_{17}	4.5e+02	1.4e+03	+	2.7e+02	−	4.2e+02	−
	(3.1e+01)	(1.0e+02)		(4.8e+01)		(2.7e+01)	
f_{18}	4.8e+02	1.4e+03	+	4.6e+02	·	4.5e+02	·
	(4.1e+01)	(1.0e+02)		(6.4e+01)		(3.0e+01)	
f_{19}	4.2e+01	2.6e+04	+	1.5e+01	−	3.2e+01	·
	(2.7e+01)	(7.2e+03)		(4.9e+00)		(5.3e+00)	
f_{20}	2.1e+01	2.3e+01	+	2.2e+01	·	2.2e+01	+
	(4.8e−01)	(2.6e−01)		(6.3e−01)		(4.6e−01)	
f_{21}	1.7e+03	3.2e+03	+	7.6e+02	−	8.5e+02	−
	(4.7e+02)	(1.9e+02)		(4.3e+02)		(3.5e+02)	
f_{22}	1.3e+04	1.2e+04	−	5.2e+03	−	1.3e+04	·
	(6.0e+02)	(4.0e+02)		(1.2e+03)		(5.6e+02)	
f_{23}	1.4e+04	1.4e+04	+	8.3e+03	−	1.4e+04	·
	(4.7e+02)	(2.8e+02)		(2.1e+03)		(4.3e+02)	
f_{24}	2.9e+02	3.9e+02	+	3.0e+02	·	2.8e+02	·
	(1.3e+01)	(4.7e+00)		(1.1e+01)		(1.5e+01)	
f_{25}	3.5e+02	4.4e+02	+	3.3e+02	−	3.3e+02	−
	(1.1e+01)	(4.3e+00)		(1.3e+01)		(1.2e+01)	
f_{26}	3.6e+02	2.7e+02	−	3.7e+02	·	3.5e+02	−
	(5.3e+01)	(6.4e+01)		(4.5e+01)		(5.0e+01)	
f_{27}	1.2e+03	2.2e+03	+	1.2e+03	·	1.0e+03	−
	(1.0e+02)	(4.0e+01)		(1.2e+02)		(8.1e+01)	
f_{28}	1.5e+03	3.4e+03	+	1.0e+03	−	9.3e+02	−
	(9.4e+02)	(2.8e+02)		(1.3e+03)		(1.1e+03)	
Summary (+/·/−)		22/3/3		5/8/15		3/12/13	

Table 221: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	2.3e−01	3.9e−03	−	3.0e−03	−	1.2e−01	−
	(5.8e−02)	(1.4e−03)		(2.5e−03)		(1.4e−02)	
f_2	1.2e+08	7.9e+07	−	1.7e+07	−	1.2e+08	·
	(1.6e+07)	(1.5e+07)		(5.6e+06)		(1.4e+07)	
f_3	6.3e+09	1.7e+09	−	3.2e+09	−	1.7e+10	+
	(1.1e+09)	(4.0e+08)		(2.2e+09)		(1.9e+09)	
f_4	9.3e+04	8.8e+04	·	6.8e+04	−	8.8e+04	·
	(9.9e+03)	(1.1e+04)		(8.4e+03)		(8.0e+03)	
f_5	4.5e−01	3.5e−02	−	9.8e−02	−	3.6e−01	−
	(9.1e−02)	(7.2e−03)		(4.9e−02)		(3.0e−02)	
f_6	4.6e+01	4.6e+01	−	4.8e+01	·	4.4e+01	−
	(3.6e−01)	(3.6e−01)		(1.1e+01)		(1.5e−01)	
f_7	7.5e+01	5.4e+01	−	8.2e+01	·	9.8e+01	+
	(6.6e+00)	(5.0e+00)		(1.9e+01)		(5.3e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.7e−02)	(4.6e−02)		(3.3e−02)		(3.6e−02)	
f_9	7.2e+01	7.2e+01	·	3.4e+01	−	7.2e+01	·
	(1.9e+00)	(1.4e+00)		(5.5e+00)		(1.6e+00)	
f_{10}	6.6e+01	5.8e+00	−	3.3e+00	−	1.6e+02	+
	(1.5e+01)	(1.3e+00)		(3.0e+00)		(1.2e+01)	
f_{11}	3.8e+02	3.3e+02	−	1.4e+02	−	3.9e+02	+
	(1.1e+01)	(1.5e+01)		(2.9e+01)		(1.3e+01)	
f_{12}	4.0e+02	3.8e+02	−	1.3e+02	−	4.2e+02	+
	(1.3e+01)	(1.3e+01)		(5.8e+01)		(1.5e+01)	
f_{13}	4.0e+02	3.8e+02	−	3.9e+02	·	4.2e+02	+
	(1.3e+01)	(1.2e+01)		(3.8e+01)		(1.5e+01)	
f_{14}	1.3e+04	1.2e+04	−	3.7e+03	−	1.3e+04	·
	(3.8e+02)	(4.2e+02)		(7.6e+02)		(3.9e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(2.9e+02)	(3.2e+02)		(5.1e+02)		(3.7e+02)	
f_{16}	3.4e+00	3.4e+00	·	3.3e+00	·	3.4e+00	·
	(2.3e−01)	(3.1e−01)		(3.0e−01)		(2.3e−01)	
f_{17}	4.4e+02	3.9e+02	−	2.3e+02	−	4.6e+02	+
	(1.7e+01)	(1.6e+01)		(3.6e+01)		(1.5e+01)	
f_{18}	4.5e+02	4.3e+02	−	4.7e+02	+	4.9e+02	+
	(1.6e+01)	(1.8e+01)		(2.3e+01)		(1.5e+01)	
f_{19}	3.5e+01	3.2e+01	−	1.2e+01	−	3.6e+01	+
	(1.1e+00)	(1.3e+00)		(2.4e+00)		(1.6e+00)	
f_{20}	2.2e+01	2.2e+01	·	2.3e+01	+	2.2e+01	·
	(3.0e−01)	(2.3e−01)		(2.8e−01)		(2.3e−01)	
f_{21}	2.1e+02	2.2e+02	−	8.8e+02	+	2.2e+02	−
	(1.2e+00)	(1.3e+02)		(3.9e+02)		(1.3e+02)	
f_{22}	1.3e+04	1.2e+04	−	4.1e+03	−	1.3e+04	·
	(3.3e+02)	(4.6e+02)		(5.2e+02)		(3.0e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(4.2e+02)	(2.6e+02)		(1.2e+03)		(3.1e+02)	
f_{24}	2.9e+02	2.5e+02	−	2.8e+02	·	3.2e+02	+
	(9.7e+00)	(1.4e+01)		(1.1e+01)		(4.3e+00)	
f_{25}	3.7e+02	3.5e+02	·	3.1e+02	−	4.1e+02	+
	(2.3e+01)	(2.0e+01)		(8.6e+00)		(9.0e+00)	
f_{26}	2.4e+02	2.4e+02	−	3.5e+02	+	4.4e+02	+
	(8.0e+01)	(8.8e+01)		(6.3e+01)		(4.1e+01)	
f_{27}	1.8e+03	1.7e+03	·	1.1e+03	−	1.9e+03	+
	(1.3e+02)	(2.2e+02)		(1.3e+02)		(6.0e+01)	
f_{28}	4.0e+02	4.0e+02	−	1.1e+03	−	4.0e+02	−
	(4.0e−01)	(7.0e−02)		(1.3e+03)		(1.3e−01)	
Summary (+/·/−)		0/9/19		4/8/16		13/10/5	

Table 222: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	8.6e+03	2.0e−03	−	0.0e+00	−	3.6e−02	−
	(2.1e+03)	(1.3e−02)		(0.0e+00)		(2.1e−02)	
f_2	1.9e+07	6.3e+06	−	9.7e+06	−	3.8e+07	+
	(1.3e+07)	(2.7e+06)		(3.1e+06)		(1.2e+07)	
f_3	1.7e+10	3.9e+08	−	1.0e+09	−	2.7e+10	+
	(7.6e+09)	(4.3e+08)		(9.3e+08)		(8.2e+09)	
f_4	1.0e+03	4.5e+04	+	4.2e+04	+	5.3e+04	+
	(2.6e+02)	(7.6e+03)		(7.1e+03)		(8.1e+03)	
f_5	1.4e+03	1.6e+01	−	6.1e−06	−	2.5e−01	−
	(4.3e+02)	(3.5e+01)		(5.0e−06)		(1.7e−01)	
f_6	4.2e+02	4.8e+01	−	4.4e+01	−	4.5e+01	−
	(7.1e+01)	(1.0e+00)		(1.7e+00)		(1.6e+00)	
f_7	2.1e+01	1.6e+01	−	7.6e+01	+	1.2e+02	+
	(1.1e+01)	(5.0e+00)		(2.3e+01)		(2.0e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.2e−02)	(3.8e−02)		(3.8e−02)		(2.9e−02)	
f_9	1.9e+01	1.9e+01	·	2.6e+01	+	6.6e+01	+
	(2.1e+00)	(6.0e+00)		(4.5e+00)		(6.7e+00)	
f_{10}	9.3e+02	2.5e+01	−	7.9e−02	−	3.3e+01	−
	(2.8e+02)	(1.3e+01)		(7.1e−02)		(1.9e+01)	
f_{11}	1.4e+02	1.4e+02	·	1.4e+02	·	4.4e+02	+
	(1.0e+02)	(3.7e+01)		(3.4e+01)		(2.3e+01)	
f_{12}	3.6e+02	2.9e+02	−	1.4e+02	−	4.7e+02	+
	(1.8e+01)	(3.7e+01)		(5.3e+01)		(2.8e+01)	
f_{13}	3.6e+02	2.9e+02	−	3.8e+02	+	4.7e+02	+
	(2.2e+01)	(6.0e+01)		(6.2e+01)		(2.2e+01)	
f_{14}	1.3e+04	1.1e+04	−	3.8e+03	−	1.3e+04	+
	(3.3e+02)	(5.0e+02)		(7.2e+02)		(3.7e+02)	
f_{15}	1.3e+04	1.4e+04	·	1.3e+04	·	1.4e+04	+
	(4.0e+02)	(3.5e+02)		(1.8e+03)		(3.2e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.4e+00	·	3.4e+00	·
	(2.7e−01)	(2.8e−01)		(2.6e−01)		(2.8e−01)	
f_{17}	3.9e+02	3.2e+02	−	2.2e+02	−	5.1e+02	+
	(1.9e+01)	(1.4e+01)		(4.3e+01)		(2.5e+01)	
f_{18}	4.0e+02	3.7e+02	−	4.7e+02	+	5.3e+02	+
	(1.6e+01)	(1.3e+01)		(2.9e+01)		(3.3e+01)	
f_{19}	1.6e+03	1.8e+01	−	1.0e+01	−	3.8e+01	−
	(1.2e+03)	(3.8e+00)		(2.5e+00)		(2.6e+00)	
f_{20}	2.1e+01	2.2e+01	+	2.2e+01	+	2.3e+01	+
	(4.3e−01)	(3.1e−01)		(3.6e−01)		(3.7e−01)	
f_{21}	2.7e+03	6.0e+02	−	7.8e+02	−	7.1e+02	−
	(4.0e+02)	(4.4e+02)		(4.2e+02)		(4.3e+02)	
f_{22}	1.2e+04	1.0e+04	−	4.1e+03	−	1.3e+04	+
	(5.0e+02)	(5.3e+02)		(6.9e+02)		(4.6e+02)	
f_{23}	1.3e+04	1.3e+04	·	1.3e+04	·	1.4e+04	+
	(4.6e+02)	(3.0e+02)		(2.3e+03)		(5.5e+02)	
f_{24}	3.0e+02	2.4e+02	−	2.8e+02	−	3.3e+02	+
	(1.3e+01)	(9.9e+00)		(1.1e+01)		(2.0e+01)	
f_{25}	3.4e+02	2.9e+02	−	3.1e+02	−	3.2e+02	−
	(1.0e+01)	(7.0e+00)		(1.4e+01)		(1.3e+01)	
f_{26}	3.3e+02	2.2e+02	−	3.5e+02	·	3.9e+02	+
	(6.6e+01)	(5.4e+01)		(5.5e+01)		(9.6e+01)	
f_{27}	1.0e+03	7.5e+02	−	1.0e+03	·	1.6e+03	+
	(7.4e+01)	(9.2e+01)		(1.1e+02)		(2.1e+02)	
f_{28}	2.9e+03	5.2e+02	−	8.8e+02	−	1.1e+03	−
	(7.7e+02)	(5.8e+02)		(1.1e+03)		(1.3e+03)	
Summary (+/·/−)		2/6/20		6/7/15		18/2/8	

Table 223: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	2.8e+02	2.4e+02	·	5.5e+03	+	1.1e+01	−
	(3.1e+02)	(1.9e+02)		(2.3e+03)		(1.3e+00)	
f_2	1.1e+05	1.0e+05	·	4.1e+06	+	9.4e+05	+
	(7.2e+04)	(6.7e+04)		(1.8e+06)		(1.1e+05)	
f_3	1.3e+09	1.3e+09	·	3.6e+10	+	2.6e+10	+
	(7.6e+08)	(9.1e+08)		(1.8e+10)		(2.5e+09)	
f_4	1.1e+03	1.1e+03	·	4.5e+04	+	5.3e+02	·
	(9.1e+02)	(8.4e+02)		(1.3e+04)		(8.6e+01)	
f_5	1.1e+01	1.0e+01	·	4.9e+02	+	4.5e+00	−
	(6.7e+00)	(8.0e+00)		(2.5e+02)		(4.1e−01)	
f_6	5.9e+01	5.6e+01	·	3.1e+02	+	4.7e+01	−
	(1.6e+01)	(1.1e+01)		(7.6e+01)		(5.7e−01)	
f_7	3.5e+01	3.5e+01	·	1.2e+02	+	1.1e+02	+
	(8.8e+00)	(7.4e+00)		(2.2e+01)		(5.5e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	+	2.1e+01	−
	(2.8e−02)	(4.0e−02)		(4.2e−02)		(3.0e−02)	
f_9	6.7e+01	6.7e+01	·	6.8e+01	·	7.3e+01	+
	(6.0e+00)	(6.3e+00)		(5.5e+00)		(1.5e+00)	
f_{10}	1.5e+01	1.9e+01	·	6.0e+02	+	2.2e+00	−
	(1.3e+01)	(1.9e+01)		(2.7e+02)		(1.5e−01)	
f_{11}	3.7e+02	3.6e+02	·	3.6e+02	·	4.2e+02	+
	(1.7e+01)	(1.7e+01)		(5.6e+01)		(1.4e+01)	
f_{12}	3.7e+02	3.7e+02	·	3.3e+02	−	4.3e+02	+
	(2.1e+01)	(1.6e+01)		(5.3e+01)		(1.4e+01)	
f_{13}	3.7e+02	3.7e+02	·	4.6e+02	+	4.3e+02	+
	(1.7e+01)	(1.9e+01)		(8.4e+01)		(1.4e+01)	
f_{14}	1.4e+04	1.4e+04	·	1.5e+04	+	1.4e+04	·
	(4.3e+02)	(3.4e+02)		(4.2e+02)		(3.5e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.5e+04	+	1.4e+04	·
	(2.8e+02)	(3.6e+02)		(3.7e+02)		(4.2e+02)	
f_{16}	3.4e+00	3.3e+00	·	4.1e+00	+	3.3e+00	·
	(3.0e−01)	(3.0e−01)		(4.8e−01)		(3.5e−01)	
f_{17}	4.2e+02	4.3e+02	·	6.3e+02	+	5.1e+02	+
	(1.8e+01)	(1.6e+01)		(1.2e+02)		(1.3e+01)	
f_{18}	4.3e+02	4.2e+02	·	7.4e+02	+	5.1e+02	+
	(1.7e+01)	(2.3e+01)		(1.6e+02)		(1.3e+01)	
f_{19}	3.3e+01	3.3e+01	·	2.8e+02	+	3.9e+01	+
	(2.1e+00)	(1.9e+00)		(2.5e+02)		(1.8e+00)	
f_{20}	2.2e+01	2.2e+01	·	2.4e+01	+	2.2e+01	·
	(2.2e−01)	(1.9e−01)		(5.7e−01)		(2.1e−01)	
f_{21}	3.3e+02	3.4e+02	·	2.0e+03	+	2.5e+02	−
	(6.2e+01)	(9.3e+01)		(6.0e+02)		(3.0e+00)	
f_{22}	1.4e+04	1.4e+04	·	1.5e+04	+	1.4e+04	·
	(5.1e+02)	(4.1e+02)		(1.4e+03)		(3.3e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.5e+04	+	1.4e+04	·
	(3.2e+02)	(3.7e+02)		(1.3e+03)		(2.8e+02)	
f_{24}	2.5e+02	2.5e+02	·	3.5e+02	+	3.4e+02	+
	(8.8e+00)	(9.5e+00)		(1.8e+01)		(4.9e+00)	
f_{25}	3.2e+02	3.2e+02	·	3.8e+02	+	4.1e+02	+
	(1.3e+01)	(1.7e+01)		(1.9e+01)		(2.2e+01)	
f_{26}	2.1e+02	2.3e+02	·	4.4e+02	+	4.3e+02	+
	(5.6e+01)	(7.6e+01)		(7.3e+01)		(6.1e+01)	
f_{27}	1.0e+03	1.1e+03	·	1.9e+03	+	2.0e+03	+
	(2.3e+02)	(2.7e+02)		(2.0e+02)		(9.0e+01)	
f_{28}	4.6e+02	4.6e+02	·	1.6e+03	+	4.2e+02	−
	(3.8e+01)	(2.7e+01)		(1.1e+03)		(1.5e+00)	
Summary (+/·/−)		0/28/0		25/2/1		14/7/7	

Table 224: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	9.5e+03	6.9e+02	−	4.6e+04	+	1.6e+04	+
	(1.4e+03)	(1.9e+02)		(1.9e+04)		(1.1e+03)	
f_2	1.7e+08	6.5e+06	−	3.7e+08	+	2.8e+08	+
	(2.4e+07)	(1.7e+06)		(2.2e+08)		(3.5e+07)	
f_3	8.7e+10	3.4e+10	−	1.6e+11	+	9.8e+10	+
	(8.4e+09)	(4.7e+09)		(1.6e+11)		(7.8e+09)	
f_4	9.6e+04	5.8e+03	−	1.2e+05	+	1.1e+05	+
	(9.7e+03)	(1.3e+03)		(2.5e+04)		(9.7e+03)	
f_5	6.8e+02	1.4e+02	−	9.8e+03	+	7.2e+02	·
	(8.1e+01)	(1.7e+01)		(3.6e+03)		(6.0e+01)	
f_6	7.0e+02	1.2e+02	−	3.5e+03	+	1.2e+03	+
	(8.6e+01)	(2.2e+01)		(1.8e+03)		(1.1e+02)	
f_7	1.9e+02	1.2e+02	−	2.4e+02	+	2.0e+02	+
	(1.0e+01)	(8.6e+00)		(5.5e+01)		(1.0e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(2.8e−02)	(2.8e−02)		(1.3e−01)		(3.7e−02)	
f_9	7.3e+01	7.2e+01	·	7.6e+01	+	7.3e+01	·
	(1.3e+00)	(3.0e+00)		(3.6e+00)		(1.4e+00)	
f_{10}	1.1e+03	8.4e+01	−	4.2e+03	+	2.0e+03	+
	(1.5e+02)	(2.2e+01)		(1.3e+03)		(1.8e+02)	
f_{11}	5.5e+02	4.1e+02	−	1.0e+03	+	6.1e+02	+
	(2.4e+01)	(1.3e+01)		(1.9e+02)		(2.2e+01)	
f_{12}	5.6e+02	4.1e+02	−	8.8e+02	+	6.5e+02	+
	(2.7e+01)	(1.5e+01)		(1.7e+02)		(2.0e+01)	
f_{13}	5.6e+02	4.1e+02	−	9.7e+02	+	6.4e+02	+
	(3.2e+01)	(1.7e+01)		(1.9e+02)		(2.8e+01)	
f_{14}	1.4e+04	1.4e+04	·	1.3e+04	·	1.4e+04	·
	(3.6e+02)	(4.1e+02)		(1.1e+03)		(2.8e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.5e+02)	(2.9e+02)		(1.1e+03)		(4.3e+02)	
f_{16}	3.2e+00	3.4e+00	·	2.6e+00	·	3.4e+00	·
	(3.1e−01)	(2.8e−01)		(1.2e+00)		(2.3e−01)	
f_{17}	9.6e+02	4.7e+02	−	2.4e+03	+	1.4e+03	+
	(6.9e+01)	(2.3e+01)		(6.5e+02)		(6.3e+01)	
f_{18}	9.5e+02	4.8e+02	−	2.3e+03	+	1.4e+03	+
	(6.3e+01)	(1.9e+01)		(6.5e+02)		(6.4e+01)	
f_{19}	1.8e+03	4.4e+01	−	3.4e+05	+	7.9e+03	+
	(7.3e+02)	(3.6e+00)		(3.1e+05)		(2.0e+03)	
f_{20}	2.3e+01	2.3e+01	−	2.4e+01	+	2.3e+01	·
	(2.2e−01)	(2.8e−01)		(6.6e−01)		(1.9e−01)	
f_{21}	1.6e+03	5.8e+02	−	5.3e+03	+	2.0e+03	+
	(9.0e+01)	(4.5e+01)		(1.3e+03)		(6.4e+01)	
f_{22}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(2.9e+02)	(5.8e+02)		(1.4e+03)		(2.4e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.1e+02)	(3.3e+02)		(1.4e+03)		(3.8e+02)	
f_{24}	4.0e+02	3.4e+02	−	4.1e+02	+	4.2e+02	+
	(6.1e+00)	(1.4e+01)		(1.1e+01)		(5.3e+00)	
f_{25}	4.5e+02	4.4e+02	−	4.4e+02	·	4.7e+02	+
	(6.6e+00)	(7.4e+00)		(1.8e+01)		(6.7e+00)	
f_{26}	2.5e+02	2.3e+02	−	4.4e+02	+	4.3e+02	+
	(7.8e+01)	(8.3e+01)		(1.1e+02)		(5.0e+01)	
f_{27}	2.3e+03	1.9e+03	−	2.4e+03	+	2.3e+03	+
	(4.2e+01)	(1.3e+02)		(8.5e+01)		(4.1e+01)	
f_{28}	1.5e+03	5.9e+02	−	5.0e+03	+	1.9e+03	+
	(9.3e+01)	(2.9e+01)		(1.5e+03)		(1.1e+02)	
Summary (+/·/−)		0/7/21		21/7/0		19/9/0	

Table 225: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	3.1e+04	3.3e+04	·	3.1e+04	·	2.7e+04	−
	(4.3e+03)	(6.5e+03)		(5.0e+03)		(6.4e+03)	
f_2	2.2e+08	5.4e+08	+	2.3e+08	·	1.9e+08	·
	(8.5e+07)	(2.6e+08)		(8.9e+07)		(6.8e+07)	
f_3	1.2e+11	1.9e+11	+	9.6e+10	·	6.3e+10	−
	(2.3e+11)	(7.9e+10)		(3.5e+10)		(2.3e+10)	
f_4	5.4e+04	1.3e+05	+	6.0e+04	+	4.9e+04	·
	(1.0e+04)	(1.4e+04)		(1.1e+04)		(1.2e+04)	
f_5	4.4e+03	5.1e+03	·	4.6e+03	·	3.5e+03	−
	(1.4e+03)	(8.5e+02)		(1.5e+03)		(1.0e+03)	
f_6	1.8e+03	2.1e+03	·	1.8e+03	·	1.5e+03	−
	(4.6e+02)	(6.7e+02)		(5.5e+02)		(3.8e+02)	
f_7	1.6e+02	2.8e+02	+	1.7e+02	·	1.5e+02	·
	(2.6e+01)	(8.7e+01)		(4.7e+01)		(2.4e+01)	
f_8	2.1e+01	2.1e+01	−	2.1e+01	·	2.1e+01	−
	(4.4e−02)	(3.5e−02)		(4.2e−02)		(3.7e−02)	
f_9	5.3e+01	7.3e+01	+	5.3e+01	·	4.8e+01	−
	(3.9e+00)	(1.4e+00)		(3.3e+00)		(3.4e+00)	
f_{10}	3.4e+03	3.7e+03	·	3.6e+03	·	3.2e+03	·
	(6.5e+02)	(7.4e+02)		(9.8e+02)		(6.6e+02)	
f_{11}	6.4e+02	7.8e+02	+	6.4e+02	·	5.5e+02	−
	(8.5e+01)	(6.7e+01)		(9.3e+01)		(9.4e+01)	
f_{12}	6.4e+02	7.7e+02	+	6.3e+02	·	5.5e+02	−
	(1.0e+02)	(8.5e+01)		(8.5e+01)		(7.3e+01)	
f_{13}	7.3e+02	7.5e+02	·	7.4e+02	·	6.5e+02	−
	(9.2e+01)	(7.8e+01)		(9.1e+01)		(8.6e+01)	
f_{14}	1.1e+04	1.4e+04	+	1.1e+04	·	8.6e+03	−
	(1.5e+03)	(4.3e+02)		(1.5e+03)		(2.4e+03)	
f_{15}	1.1e+04	1.4e+04	+	1.2e+04	·	9.5e+03	−
	(1.6e+03)	(4.7e+02)		(1.5e+03)		(2.5e+03)	
f_{16}	4.1e+00	3.4e+00	−	4.2e+00	·	3.3e+00	−
	(3.7e−01)	(3.1e−01)		(3.8e−01)		(3.2e−01)	
f_{17}	1.0e+03	1.5e+03	+	1.1e+03	·	8.3e+02	−
	(1.7e+02)	(1.8e+02)		(1.7e+02)		(1.3e+02)	
f_{18}	1.2e+03	1.5e+03	+	1.1e+03	·	9.5e+02	−
	(1.6e+02)	(1.5e+02)		(1.5e+02)		(1.3e+02)	
f_{19}	3.6e+04	9.2e+04	+	4.5e+04	·	2.0e+04	−
	(2.5e+04)	(8.7e+04)		(3.5e+04)		(1.4e+04)	
f_{20}	2.3e+01	2.4e+01	+	2.3e+01	·	2.2e+01	−
	(9.9e−01)	(2.7e−01)		(8.9e−01)		(1.0e+00)	
f_{21}	4.0e+03	3.9e+03	·	4.0e+03	·	3.8e+03	−
	(3.3e+02)	(3.8e+02)		(2.6e+02)		(2.3e+02)	
f_{22}	1.2e+04	1.5e+04	+	1.2e+04	·	9.3e+03	−
	(1.4e+03)	(4.2e+02)		(1.1e+03)		(1.5e+03)	
f_{23}	1.2e+04	1.5e+04	+	1.2e+04	·	9.5e+03	−
	(1.4e+03)	(4.1e+02)		(1.6e+03)		(1.5e+03)	
f_{24}	3.8e+02	4.2e+02	+	3.8e+02	·	3.8e+02	·
	(1.2e+01)	(1.7e+01)		(1.5e+01)		(1.4e+01)	
f_{25}	4.2e+02	4.8e+02	+	4.3e+02	·	4.1e+02	−
	(1.3e+01)	(1.1e+01)		(1.8e+01)		(1.3e+01)	
f_{26}	4.2e+02	2.8e+02	−	4.3e+02	·	4.2e+02	−
	(6.6e+01)	(4.5e+01)		(5.3e+01)		(5.2e+01)	
f_{27}	1.8e+03	2.3e+03	+	1.8e+03	·	1.7e+03	·
	(1.0e+02)	(4.3e+01)		(1.1e+02)		(9.9e+01)	
f_{28}	5.6e+03	4.8e+03	−	5.5e+03	·	5.1e+03	−
	(8.7e+02)	(6.0e+02)		(7.6e+02)		(7.4e+02)	
Summary (+/·/−)		18/6/4		1/27/0		0/6/22	

Table 226: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.5e+03	1.5e+05	+	2.7e+03	+	7.1e+02	−
	(9.4e+02)	(1.0e+04)		(1.3e+03)		(6.8e+02)	
f_2	1.3e+06	3.9e+09	+	3.4e+06	+	7.3e+05	−
	(6.7e+05)	(9.2e+08)		(1.9e+06)		(4.2e+05)	
f_3	1.1e+09	1.2e+18	+	8.9e+09	+	3.0e+08	−
	(1.1e+09)	(2.4e+18)		(5.2e+09)		(2.0e+08)	
f_4	2.6e+03	2.8e+05	+	1.1e+04	+	9.9e+02	−
	(1.7e+03)	(7.7e+04)		(4.7e+03)		(6.9e+02)	
f_5	1.4e+02	6.7e+04	+	2.5e+02	+	1.1e+02	·
	(3.9e+01)	(1.1e+04)		(8.5e+01)		(4.9e+01)	
f_6	1.1e+02	2.3e+04	+	2.0e+02	+	8.7e+01	−
	(3.1e+01)	(3.6e+03)		(6.1e+01)		(3.1e+01)	
f_7	9.3e+01	5.0e+05	+	1.4e+02	+	8.1e+01	·
	(2.7e+01)	(4.4e+05)		(3.7e+01)		(2.5e+01)	
f_8	2.1e+01	2.1e+01	+	2.1e+01	+	2.1e+01	·
	(3.8e−02)	(4.4e−02)		(4.2e−02)		(3.3e−02)	
f_9	2.7e+01	8.2e+01	+	4.4e+01	+	2.5e+01	−
	(3.4e+00)	(2.3e+00)		(9.7e+00)		(8.7e+00)	
f_{10}	1.8e+02	2.0e+04	+	4.1e+02	+	8.9e+01	−
	(9.4e+01)	(2.3e+03)		(1.8e+02)		(5.9e+01)	
f_{11}	4.8e+02	2.3e+03	+	4.7e+02	·	4.8e+02	·
	(4.4e+01)	(2.3e+02)		(1.0e+02)		(5.0e+01)	
f_{12}	4.8e+02	2.1e+03	+	4.9e+02	·	4.7e+02	·
	(4.3e+01)	(1.6e+02)		(8.0e+01)		(4.2e+01)	
f_{13}	4.8e+02	2.2e+03	+	5.6e+02	+	4.8e+02	·
	(5.3e+01)	(1.5e+02)		(5.5e+01)		(5.1e+01)	
f_{14}	1.4e+04	1.6e+04	+	1.4e+04	+	1.4e+04	·
	(3.8e+02)	(6.4e+02)		(6.4e+02)		(4.0e+02)	
f_{15}	1.4e+04	1.7e+04	+	1.5e+04	+	1.4e+04	·
	(3.6e+02)	(4.9e+02)		(5.8e+02)		(4.9e+02)	
f_{16}	3.3e+00	5.9e+00	+	4.2e+00	+	3.4e+00	·
	(2.7e−01)	(5.8e−01)		(3.5e−01)		(2.9e−01)	
f_{17}	6.3e+02	4.8e+03	+	7.4e+02	+	6.0e+02	·
	(6.5e+01)	(3.0e+02)		(8.2e+01)		(6.2e+01)	
f_{18}	6.1e+02	4.7e+03	+	7.6e+02	+	5.8e+02	·
	(7.3e+01)	(3.1e+02)		(8.8e+01)		(5.5e+01)	
f_{19}	4.9e+01	1.4e+07	+	1.2e+02	+	4.1e+01	−
	(1.2e+01)	(5.1e+06)		(9.6e+01)		(5.5e+00)	
f_{20}	2.2e+01	2.5e+01	+	2.3e+01	+	2.2e+01	·
	(3.4e−01)	(3.3e−07)		(5.5e−01)		(3.3e−01)	
f_{21}	1.2e+03	1.1e+04	+	1.6e+03	+	1.1e+03	·
	(3.4e+02)	(8.0e+02)		(4.4e+02)		(3.4e+02)	
f_{22}	1.4e+04	1.7e+04	+	1.5e+04	+	1.4e+04	·
	(5.0e+02)	(3.6e+02)		(6.6e+02)		(5.0e+02)	
f_{23}	1.4e+04	1.8e+04	+	1.5e+04	+	1.4e+04	·
	(4.7e+02)	(4.3e+02)		(6.4e+02)		(4.3e+02)	
f_{24}	2.9e+02	8.1e+02	+	3.2e+02	+	2.8e+02	−
	(1.0e+01)	(1.1e+02)		(1.3e+01)		(1.3e+01)	
f_{25}	3.2e+02	6.2e+02	+	3.5e+02	+	3.2e+02	·
	(1.0e+01)	(2.6e+01)		(1.2e+01)		(9.9e+00)	
f_{26}	3.6e+02	5.4e+02	+	4.0e+02	+	3.6e+02	−
	(3.4e+01)	(1.3e+01)		(4.2e+01)		(3.3e+01)	
f_{27}	1.1e+03	3.0e+03	+	1.4e+03	+	9.9e+02	−
	(7.5e+01)	(1.5e+02)		(1.3e+02)		(7.6e+01)	
f_{28}	1.4e+03	1.4e+04	+	1.5e+03	+	1.0e+03	−
	(1.3e+03)	(8.8e+02)		(1.2e+03)		(1.1e+03)	
Summary (+/·/−)		28/0/0		26/2/0		0/16/12	

Table 227: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.4e+04	1.4e+05	+	3.0e+03	−	1.7e+04	+
	(2.9e+03)	(1.3e+04)		(1.2e+03)		(2.8e+03)	
f_2	4.7e+07	4.0e+09	+	3.9e+06	−	6.5e+07	+
	(2.4e+07)	(7.6e+08)		(2.2e+06)		(2.9e+07)	
f_3	9.4e+09	4.0e+17	+	6.8e+09	−	1.7e+10	+
	(3.6e+09)	(6.2e+17)		(2.9e+09)		(4.4e+09)	
f_4	2.3e+04	2.9e+05	+	9.6e+03	−	2.8e+04	+
	(4.1e+03)	(1.0e+05)		(3.6e+03)		(4.9e+03)	
f_5	8.6e+02	6.1e+04	+	2.4e+02	−	9.1e+02	·
	(2.0e+02)	(1.1e+04)		(8.0e+01)		(2.4e+02)	
f_6	5.7e+02	2.4e+04	+	2.0e+02	−	7.1e+02	+
	(1.1e+02)	(3.9e+03)		(6.4e+01)		(1.9e+02)	
f_7	2.4e+01	4.6e+05	+	1.4e+02	+	2.0e+01	·
	(9.6e+00)	(4.6e+05)		(3.9e+01)		(7.9e+00)	
f_8	2.1e+01	2.1e+01	+	2.1e+01	+	2.1e+01	·
	(3.8e−02)	(6.6e−02)		(5.6e−02)		(3.2e−02)	
f_9	2.1e+01	8.3e+01	+	4.3e+01	+	1.8e+01	−
	(4.5e+00)	(2.0e+00)		(8.2e+00)		(2.6e+00)	
f_{10}	1.4e+03	2.1e+04	+	4.0e+02	−	1.9e+03	+
	(2.9e+02)	(2.0e+03)		(1.9e+02)		(3.8e+02)	
f_{11}	3.8e+02	2.3e+03	+	4.7e+02	+	3.8e+02	·
	(2.2e+01)	(2.3e+02)		(8.9e+01)		(2.0e+01)	
f_{12}	3.8e+02	2.1e+03	+	4.8e+02	+	4.0e+02	·
	(2.8e+01)	(1.6e+02)		(7.8e+01)		(2.7e+01)	
f_{13}	3.8e+02	2.1e+03	+	5.6e+02	+	4.0e+02	·
	(2.4e+01)	(1.7e+02)		(5.9e+01)		(3.0e+01)	
f_{14}	1.3e+04	1.6e+04	+	1.5e+04	+	1.3e+04	·
	(3.3e+02)	(5.2e+02)		(4.4e+02)		(3.7e+02)	
f_{15}	1.4e+04	1.7e+04	+	1.5e+04	+	1.4e+04	·
	(3.2e+02)	(5.8e+02)		(4.5e+02)		(3.9e+02)	
f_{16}	3.3e+00	5.8e+00	+	4.3e+00	+	3.2e+00	·
	(3.1e−01)	(7.2e−01)		(3.6e−01)		(3.0e−01)	
f_{17}	4.1e+02	4.7e+03	+	7.5e+02	+	4.0e+02	·
	(2.2e+01)	(2.7e+02)		(9.6e+01)		(2.0e+01)	
f_{18}	4.1e+02	4.7e+03	+	7.6e+02	+	4.0e+02	·
	(2.1e+01)	(2.5e+02)		(8.7e+01)		(1.9e+01)	
f_{19}	1.4e+03	1.4e+07	+	1.2e+02	−	2.7e+03	+
	(1.1e+03)	(5.3e+06)		(9.6e+01)		(1.5e+03)	
f_{20}	2.1e+01	2.5e+01	+	2.3e+01	+	2.1e+01	−
	(2.5e−01)	(9.4e−03)		(5.5e−01)		(3.3e−01)	
f_{21}	1.7e+03	1.1e+04	+	1.5e+03	·	1.7e+03	·
	(2.7e+02)	(6.3e+02)		(4.6e+02)		(3.6e+02)	
f_{22}	1.3e+04	1.7e+04	+	1.5e+04	+	1.3e+04	·
	(3.9e+02)	(4.0e+02)		(5.9e+02)		(4.3e+02)	
f_{23}	1.3e+04	1.8e+04	+	1.5e+04	+	1.3e+04	−
	(3.7e+02)	(4.6e+02)		(6.5e+02)		(3.7e+02)	
f_{24}	3.0e+02	8.0e+02	+	3.2e+02	+	3.6e+02	+
	(1.4e+01)	(1.0e+02)		(1.2e+01)		(1.6e+01)	
f_{25}	3.3e+02	6.2e+02	+	3.5e+02	·	3.4e+02	·
	(1.8e+01)	(2.7e+01)		(1.2e+01)		(1.6e+01)	
f_{26}	2.0e+02	5.4e+02	+	4.0e+02	+	3.3e+02	+
	(2.3e+00)	(1.1e+01)		(4.3e+01)		(2.0e+01)	
f_{27}	8.5e+02	3.1e+03	+	1.4e+03	+	9.7e+02	+
	(7.9e+01)	(1.8e+02)		(1.5e+02)		(7.2e+01)	
f_{28}	1.6e+03	1.4e+04	+	1.7e+03	−	2.1e+03	+
	(2.6e+02)	(1.0e+03)		(1.3e+03)		(2.9e+02)	
Summary (+/·/−)		28/0/0		17/2/9		11/14/3	

Table 228: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	8.1e+03	1.3e+04	+	1.2e+04	+	8.6e+03	·
	(2.6e+03)	(5.3e+03)		(3.6e+03)		(2.8e+03)	
f_2	4.4e+07	1.6e+08	+	5.6e+07	·	3.7e+07	·
	(2.4e+07)	(5.6e+07)		(2.7e+07)		(1.7e+07)	
f_3	2.3e+10	8.3e+10	+	3.2e+10	+	1.5e+10	−
	(7.6e+09)	(1.6e+10)		(1.2e+10)		(8.3e+09)	
f_4	2.1e+04	8.9e+04	+	2.9e+04	+	2.0e+04	·
	(6.4e+03)	(1.5e+04)		(9.1e+03)		(6.8e+03)	
f_5	1.2e+03	8.5e+02	−	1.6e+03	+	1.2e+03	·
	(3.2e+02)	(4.0e+02)		(6.0e+02)		(4.3e+02)	
f_6	4.4e+02	9.7e+02	+	5.9e+02	+	4.3e+02	·
	(1.2e+02)	(3.8e+02)		(1.9e+02)		(1.3e+02)	
f_7	7.1e+01	1.9e+02	+	1.4e+02	+	7.4e+01	·
	(1.3e+01)	(2.9e+01)		(3.6e+01)		(2.2e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	+	2.1e+01	·
	(3.2e−02)	(4.3e−02)		(4.0e−02)		(2.9e−02)	
f_9	3.6e+01	6.4e+01	+	4.5e+01	+	3.5e+01	·
	(3.4e+00)	(5.0e+00)		(4.2e+00)		(3.2e+00)	
f_{10}	1.0e+03	2.2e+03	+	1.7e+03	+	1.1e+03	·
	(2.9e+02)	(6.3e+02)		(5.0e+02)		(3.8e+02)	
f_{11}	2.7e+02	5.5e+02	+	4.4e+02	+	2.9e+02	·
	(5.2e+01)	(5.4e+01)		(7.7e+01)		(5.2e+01)	
f_{12}	2.5e+02	5.9e+02	+	4.6e+02	+	2.9e+02	·
	(4.4e+01)	(6.8e+01)		(9.2e+01)		(5.3e+01)	
f_{13}	3.8e+02	6.0e+02	+	6.1e+02	+	4.5e+02	+
	(6.9e+01)	(7.9e+01)		(8.8e+01)		(8.5e+01)	
f_{14}	1.3e+04	1.4e+04	+	1.4e+04	+	1.3e+04	·
	(4.5e+02)	(4.8e+02)		(9.7e+02)		(4.7e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.5e+04	+	1.4e+04	·
	(5.8e+02)	(3.6e+02)		(7.0e+02)		(4.9e+02)	
f_{16}	3.3e+00	3.4e+00	·	4.2e+00	+	3.4e+00	·
	(2.7e−01)	(3.0e−01)		(4.2e−01)		(2.8e−01)	
f_{17}	6.1e+02	5.6e+02	−	8.6e+02	+	6.4e+02	·
	(7.6e+01)	(1.0e+02)		(1.2e+02)		(6.3e+01)	
f_{18}	6.2e+02	5.6e+02	−	9.0e+02	+	6.4e+02	·
	(7.5e+01)	(9.3e+01)		(9.7e+01)		(7.5e+01)	
f_{19}	8.0e+02	1.1e+04	+	2.1e+03	+	5.2e+02	·
	(1.2e+03)	(1.1e+04)		(3.2e+03)		(5.7e+02)	
f_{20}	2.1e+01	2.3e+01	+	2.3e+01	+	2.1e+01	·
	(5.9e−01)	(4.1e−01)		(6.1e−01)		(5.4e−01)	
f_{21}	2.8e+03	2.7e+03	·	2.8e+03	·	2.5e+03	·
	(5.2e+02)	(3.7e+02)		(4.3e+02)		(4.1e+02)	
f_{22}	1.3e+04	1.4e+04	+	1.4e+04	+	1.3e+04	+
	(1.3e+03)	(4.3e+02)		(1.3e+03)		(9.3e+02)	
f_{23}	1.3e+04	1.4e+04	+	1.5e+04	+	1.4e+04	·
	(1.2e+03)	(3.9e+02)		(1.0e+03)		(6.9e+02)	
f_{24}	3.2e+02	3.9e+02	+	3.4e+02	+	3.2e+02	·
	(1.4e+01)	(1.2e+01)		(1.1e+01)		(1.2e+01)	
f_{25}	3.8e+02	4.4e+02	+	3.8e+02	·	3.7e+02	·
	(1.5e+01)	(1.0e+01)		(1.4e+01)		(1.4e+01)	
f_{26}	3.7e+02	2.7e+02	·	4.0e+02	+	3.8e+02	·
	(6.8e+01)	(1.0e+02)		(5.9e+01)		(5.2e+01)	
f_{27}	1.4e+03	2.1e+03	+	1.5e+03	+	1.4e+03	·
	(1.0e+02)	(1.1e+02)		(1.0e+02)		(8.9e+01)	
f_{28}	2.9e+03	3.2e+03	·	3.4e+03	·	2.9e+03	·
	(9.8e+02)	(4.7e+02)		(1.1e+03)		(1.1e+03)	
Summary (+/·/−)		19/6/3		24/4/0		2/25/1	

Table 229: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_{\mathrm{r}} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	7.0e−02	8.5e+02	+	4.3e+03	+	2.4e−01	+
	(7.4e−02)	(9.0e+02)		(1.9e+03)		(2.8e−02)	
f_2	1.2e+03	1.9e+05	+	2.7e+06	+	1.3e+04	+
	(1.5e+03)	(1.2e+05)		(1.4e+06)		(2.3e+03)	
f_3	1.1e+09	7.4e+08	·	2.8e+10	+	1.3e+10	+
	(5.2e+08)	(4.4e+08)		(1.6e+10)		(1.8e+09)	
f_4	1.0e+00	2.7e+03	+	3.4e+04	+	8.2e+00	+
	(1.0e+00)	(1.9e+03)		(9.9e+03)		(1.2e+00)	
f_5	1.2e−01	2.7e+01	+	3.5e+02	+	4.2e−01	+
	(4.2e−02)	(1.4e+01)		(1.6e+02)		(4.1e−02)	
f_6	4.5e+01	8.3e+01	+	2.5e+02	+	4.4e+01	−
	(1.4e+00)	(2.4e+01)		(6.6e+01)		(1.5e−02)	
f_7	3.3e+01	3.0e+01	·	1.2e+02	+	8.4e+01	+
	(7.3e+00)	(8.6e+00)		(2.7e+01)		(4.7e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	+	2.1e+01	·
	(3.8e−02)	(4.6e−02)		(4.4e−02)		(2.8e−02)	
f_9	7.2e+01	6.0e+01	−	6.8e+01	·	7.3e+01	·
	(1.2e+00)	(8.3e+00)		(5.8e+00)		(1.4e+00)	
f_{10}	4.9e−01	3.8e+01	+	4.4e+02	+	1.0e+00	+
	(2.6e−01)	(2.1e+01)		(1.9e+02)		(1.9e−02)	
f_{11}	3.7e+02	3.7e+02	·	3.4e+02	−	4.0e+02	+
	(1.3e+01)	(2.1e+01)		(5.0e+01)		(1.3e+01)	
f_{12}	3.7e+02	3.7e+02	·	3.1e+02	−	4.1e+02	+
	(1.6e+01)	(2.1e+01)		(5.1e+01)		(1.5e+01)	
f_{13}	3.7e+02	3.7e+02	·	4.6e+02	+	4.1e+02	+
	(1.6e+01)	(1.9e+01)		(8.0e+01)		(1.4e+01)	
f_{14}	1.4e+04	1.4e+04	·	1.5e+04	+	1.4e+04	·
	(4.4e+02)	(4.1e+02)		(9.3e+02)		(3.3e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.5e+04	+	1.4e+04	·
	(3.7e+02)	(3.3e+02)		(1.3e+03)		(2.9e+02)	
f_{16}	3.3e+00	3.5e+00	+	4.1e+00	+	3.3e+00	·
	(2.5e−01)	(2.4e−01)		(4.5e−01)		(2.7e−01)	
f_{17}	4.3e+02	4.3e+02	·	6.3e+02	+	4.8e+02	+
	(1.4e+01)	(2.0e+01)		(1.3e+02)		(1.7e+01)	
f_{18}	4.2e+02	4.3e+02	·	6.9e+02	+	4.8e+02	+
	(1.7e+01)	(2.2e+01)		(1.4e+02)		(1.4e+01)	
f_{19}	3.3e+01	3.3e+01	·	2.1e+02	+	3.6e+01	+
	(1.3e+00)	(2.7e+00)		(1.7e+02)		(1.3e+00)	
f_{20}	2.2e+01	2.2e+01	−	2.3e+01	+	2.2e+01	·
	(1.9e−01)	(2.7e−01)		(8.0e−01)		(2.2e−01)	
f_{21}	2.2e+02	4.6e+02	+	1.9e+03	+	2.1e+02	+
	(8.9e+01)	(1.6e+02)		(5.6e+02)		(5.1e−01)	
f_{22}	1.4e+04	1.4e+04	·	1.5e+04	+	1.4e+04	·
	(3.4e+02)	(4.5e+02)		(1.1e+03)		(3.9e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.5e+04	+	1.4e+04	·
	(3.8e+02)	(3.5e+02)		(1.2e+03)		(3.2e+02)	
f_{24}	2.4e+02	2.5e+02	·	3.6e+02	+	3.1e+02	+
	(7.6e+00)	(8.9e+00)		(1.8e+01)		(4.8e+00)	
f_{25}	3.2e+02	3.0e+02	−	3.7e+02	+	3.8e+02	+
	(1.6e+01)	(1.1e+01)		(2.3e+01)		(2.7e+01)	
f_{26}	2.3e+02	2.2e+02	+	4.3e+02	+	4.5e+02	+
	(8.1e+01)	(5.8e+01)		(7.9e+01)		(3.6e+01)	
f_{27}	9.6e+02	9.0e+02	−	1.8e+03	+	1.8e+03	+
	(1.8e+02)	(1.5e+02)		(1.9e+02)		(1.1e+02)	
f_{28}	4.0e+02	5.1e+02	+	1.7e+03	+	4.0e+02	+
	(6.4e−01)	(4.3e+01)		(1.2e+03)		(1.9e−01)	
Summary (+/·/−)		10/14/4		25/1/2		19/8/1	

Table 230: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.5}$ and $C_\mathrm{r} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	2.2e+04	3.8e+04	+	2.2e+03	−	8.1e+01	−
	(3.8e+03)	(4.9e+03)		(1.3e+03)		(8.6e+01)	
f_2	1.2e+08	4.3e+08	+	1.6e+06	−	1.8e+05	−
	(5.4e+07)	(1.5e+08)		(9.2e+05)		(1.3e+05)	
f_3	4.7e+10	2.0e+11	+	7.8e+09	−	4.9e+08	−
	(1.4e+10)	(3.3e+11)		(6.3e+09)		(6.0e+08)	
f_4	4.4e+04	6.2e+04	+	9.6e+03	−	1.9e+02	−
	(8.0e+03)	(8.5e+03)		(4.5e+03)		(2.7e+02)	
f_5	2.4e+03	5.5e+03	+	1.8e+02	−	5.0e+01	−
	(9.6e+02)	(1.6e+03)		(7.1e+01)		(4.2e+01)	
f_6	1.0e+03	2.6e+03	+	1.6e+02	−	5.5e+01	−
	(2.2e+02)	(6.2e+02)		(4.5e+01)		(1.7e+01)	
f_7	6.3e+01	1.5e+02	+	1.3e+02	+	9.4e+01	+
	(1.2e+01)	(5.3e+01)		(3.1e+01)		(2.9e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	+	2.1e+01	·
	(3.5e−02)	(5.1e−02)		(4.2e−02)		(4.2e−02)	
f_9	3.3e+01	4.8e+01	+	4.9e+01	+	4.1e+01	·
	(2.4e+00)	(2.1e+00)		(1.1e+01)		(1.5e+01)	
f_{10}	2.3e+03	4.9e+03	+	2.6e+02	−	2.4e+01	−
	(5.0e+02)	(8.7e+02)		(1.1e+02)		(4.0e+01)	
f_{11}	2.9e+02	5.4e+02	+	4.3e+02	+	4.9e+02	+
	(4.5e+01)	(5.6e+01)		(6.1e+01)		(3.8e+01)	
f_{12}	2.9e+02	5.9e+02	+	4.3e+02	+	4.8e+02	+
	(4.6e+01)	(5.8e+01)		(7.3e+01)		(4.3e+01)	
f_{13}	4.6e+02	6.4e+02	+	5.2e+02	·	5.0e+02	·
	(5.8e+01)	(4.8e+01)		(5.8e+01)		(4.6e+01)	
f_{14}	1.3e+04	1.0e+04	−	1.5e+04	+	1.4e+04	+
	(3.7e+02)	(1.3e+03)		(4.8e+02)		(4.6e+02)	
f_{15}	1.4e+04	1.1e+04	−	1.5e+04	+	1.4e+04	+
	(3.5e+02)	(1.2e+03)		(4.4e+02)		(4.5e+02)	
f_{16}	3.4e+00	3.5e+00	·	4.2e+00	+	3.3e+00	·
	(2.8e−01)	(3.1e−01)		(3.8e−01)		(2.6e−01)	
f_{17}	6.5e+02	6.7e+02	·	7.3e+02	+	6.0e+02	·
	(6.7e+01)	(7.3e+01)		(9.0e+01)		(7.1e+01)	
f_{18}	6.4e+02	7.2e+02	+	7.3e+02	+	5.9e+02	−
	(6.4e+01)	(1.0e+02)		(7.8e+01)		(5.6e+01)	
f_{19}	1.1e+04	6.9e+04	+	7.9e+01	−	4.0e+01	−
	(9.1e+03)	(3.8e+04)		(4.0e+01)		(3.2e+00)	
f_{20}	2.1e+01	2.1e+01	·	2.3e+01	+	2.3e+01	+
	(4.6e−01)	(9.3e−01)		(4.6e−01)		(3.1e−01)	
f_{21}	3.6e+03	4.2e+03	+	1.4e+03	−	8.1e+02	−
	(2.5e+02)	(1.5e+02)		(4.5e+02)		(3.6e+02)	
f_{22}	1.3e+04	9.2e+03	−	1.5e+04	+	1.4e+04	+
	(4.7e+02)	(9.3e+02)		(8.4e+02)		(4.5e+02)	
f_{23}	1.3e+04	9.5e+03	−	1.5e+04	+	1.4e+04	+
	(4.3e+02)	(1.1e+03)		(5.4e+02)		(4.2e+02)	
f_{24}	3.6e+02	4.8e+02	+	3.2e+02	−	2.8e+02	−
	(1.2e+01)	(3.3e+01)		(1.6e+01)		(9.9e+00)	
f_{25}	4.0e+02	4.5e+02	+	3.4e+02	−	3.1e+02	−
	(1.3e+01)	(1.3e+01)		(1.5e+01)		(1.1e+01)	
f_{26}	3.6e+02	3.2e+02	·	3.9e+02	·	3.5e+02	−
	(7.5e+01)	(8.6e+01)		(5.8e+01)		(4.1e+01)	
f_{27}	1.5e+03	2.0e+03	+	1.4e+03	·	1.0e+03	−
	(6.8e+01)	(9.3e+01)		(1.6e+02)		(1.2e+02)	
f_{28}	4.6e+03	6.1e+03	+	1.9e+03	−	1.2e+03	−
	(6.1e+02)	(4.6e+02)		(1.5e+03)		(1.4e+03)	
Summary (+/·/−)		19/5/4		13/3/12		8/5/15	

Table 231: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	8.1e+02	8.4e+02	·	2.1e+02	−	1.0e+04	+
	(1.2e+02)	(1.5e+02)		(3.1e+02)		(8.2e+02)	
f_2	2.6e+08	2.7e+08	·	1.3e+07	−	4.1e+08	+
	(4.2e+07)	(4.7e+07)		(5.3e+06)		(5.5e+07)	
f_3	5.3e+10	5.2e+10	·	6.9e+09	−	8.5e+10	+
	(5.8e+09)	(4.9e+09)		(2.9e+09)		(7.2e+09)	
f_4	1.1e+05	1.1e+05	·	9.0e+04	−	1.2e+05	·
	(1.2e+04)	(1.2e+04)		(1.3e+04)		(1.0e+04)	
f_5	1.7e+02	1.7e+02	·	1.9e+01	−	4.6e+02	+
	(1.5e+01)	(1.7e+01)		(4.1e+01)		(3.2e+01)	
f_6	1.4e+02	1.5e+02	·	7.3e+01	−	8.8e+02	+
	(1.6e+01)	(1.5e+01)		(3.1e+01)		(7.9e+01)	
f_7	1.5e+02	1.5e+02	·	7.9e+01	−	1.8e+02	+
	(6.8e+00)	(6.3e+00)		(1.7e+01)		(7.9e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.2e−02)	(3.6e−02)		(3.6e−02)		(3.1e−02)	
f_9	7.2e+01	7.2e+01	·	4.3e+01	−	7.3e+01	·
	(1.3e+00)	(1.1e+00)		(6.6e+00)		(1.6e+00)	
f_{10}	7.1e+02	7.3e+02	·	7.6e+01	−	2.7e+03	+
	(9.9e+01)	(1.1e+02)		(5.3e+01)		(2.1e+02)	
f_{11}	4.1e+02	4.1e+02	·	1.1e+02	−	5.5e+02	+
	(1.7e+01)	(1.5e+01)		(2.3e+01)		(1.8e+01)	
f_{12}	4.5e+02	4.4e+02	·	1.8e+02	−	6.2e+02	+
	(1.8e+01)	(2.2e+01)		(4.3e+01)		(2.0e+01)	
f_{13}	4.4e+02	4.5e+02	·	3.4e+02	−	6.3e+02	+
	(2.8e+01)	(1.9e+01)		(7.0e+01)		(2.1e+01)	
f_{14}	1.2e+04	1.2e+04	·	2.2e+03	−	1.3e+04	+
	(4.7e+02)	(4.3e+02)		(4.8e+02)		(3.3e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(2.9e+02)	(3.7e+02)		(4.7e+02)		(3.8e+02)	
f_{16}	3.4e+00	3.3e+00	·	3.4e+00	·	3.4e+00	·
	(2.5e−01)	(3.2e−01)		(2.8e−01)		(2.8e−01)	
f_{17}	5.1e+02	5.1e+02	·	2.9e+02	−	1.2e+03	+
	(1.8e+01)	(2.0e+01)		(6.9e+01)		(6.4e+01)	
f_{18}	5.2e+02	5.2e+02	·	3.3e+02	−	1.2e+03	+
	(2.6e+01)	(2.3e+01)		(7.5e+01)		(6.0e+01)	
f_{19}	5.8e+01	5.8e+01	·	2.6e+01	−	3.6e+03	+
	(4.3e+00)	(5.1e+00)		(1.8e+01)		(1.1e+03)	
f_{20}	2.3e+01	2.3e+01	·	2.3e+01	·	2.3e+01	·
	(2.6e−01)	(2.5e−01)		(3.3e−01)		(2.4e−01)	
f_{21}	7.0e+02	7.1e+02	·	8.9e+02	·	1.7e+03	+
	(4.4e+01)	(3.6e+01)		(3.8e+02)		(6.0e+01)	
f_{22}	1.2e+04	1.3e+04	·	2.4e+03	−	1.4e+04	+
	(4.7e+02)	(4.4e+02)		(5.5e+02)		(3.4e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.4e+02)	(3.5e+02)		(5.9e+02)		(3.4e+02)	
f_{24}	3.7e+02	3.7e+02	·	3.0e+02	−	3.9e+02	+
	(7.2e+00)	(7.6e+00)		(9.3e+00)		(3.5e+00)	
f_{25}	4.3e+02	4.3e+02	·	3.2e+02	−	4.4e+02	+
	(4.8e+00)	(5.0e+00)		(1.2e+01)		(4.8e+00)	
f_{26}	2.8e+02	2.7e+02	·	3.2e+02	·	4.4e+02	+
	(8.0e+01)	(7.6e+01)		(1.0e+02)		(3.9e+01)	
f_{27}	2.2e+03	2.2e+03	·	1.3e+03	−	2.2e+03	+
	(5.6e+01)	(5.1e+01)		(1.1e+02)		(3.1e+01)	
f_{28}	6.4e+02	6.4e+02	·	9.0e+02	−	1.5e+03	+
	(2.4e+01)	(2.3e+01)		(1.1e+03)		(5.9e+01)	
Summary (+/·/−)		0/28/0		0/7/21		21/7/0	

Table 232: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	3.5e+04	3.0e+04	−	7.2e+03	−	4.1e+04	+
	(5.0e+03)	(2.8e+03)		(2.8e+03)		(3.2e+03)	
f_2	7.0e+08	6.7e+08	·	6.5e+07	−	7.5e+08	+
	(9.5e+07)	(1.0e+08)		(3.4e+07)		(1.0e+08)	
f_3	1.6e+11	1.5e+11	·	2.5e+10	−	1.8e+11	+
	(1.5e+10)	(1.2e+10)		(1.2e+10)		(2.3e+10)	
f_4	1.3e+05	1.3e+05	·	1.1e+05	−	1.3e+05	·
	(1.1e+04)	(8.6e+03)		(1.1e+04)		(9.9e+03)	
f_5	4.4e+03	4.0e+03	·	1.1e+03	−	4.2e+03	·
	(5.0e+02)	(4.8e+02)		(6.7e+02)		(3.7e+02)	
f_6	2.7e+03	2.3e+03	−	4.8e+02	−	3.3e+03	+
	(3.9e+02)	(3.0e+02)		(1.6e+02)		(3.8e+02)	
f_7	2.6e+02	2.4e+02	−	1.3e+02	−	2.8e+02	·
	(2.0e+01)	(1.7e+01)		(2.6e+01)		(1.9e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.7e−02)	(3.0e−02)		(3.6e−02)		(3.5e−02)	
f_9	7.3e+01	7.3e+01	·	5.9e+01	−	7.3e+01	·
	(1.3e+00)	(1.5e+00)		(7.3e+00)		(1.6e+00)	
f_{10}	5.8e+03	5.5e+03	·	1.3e+03	−	6.3e+03	+
	(5.0e+02)	(5.2e+02)		(4.0e+02)		(4.6e+02)	
f_{11}	8.5e+02	7.5e+02	−	3.0e+02	−	8.9e+02	·
	(5.4e+01)	(3.7e+01)		(5.1e+01)		(3.4e+01)	
f_{12}	8.9e+02	8.5e+02	−	4.5e+02	−	9.4e+02	+
	(5.0e+01)	(4.8e+01)		(5.8e+01)		(3.8e+01)	
f_{13}	8.9e+02	8.5e+02	·	4.4e+02	−	9.5e+02	+
	(5.8e+01)	(3.2e+01)		(6.0e+01)		(4.3e+01)	
f_{14}	1.3e+04	1.1e+04	−	4.1e+03	−	1.3e+04	·
	(3.2e+02)	(3.8e+02)		(7.0e+02)		(3.5e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.7e+02)	(4.1e+02)		(4.1e+02)		(4.0e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.3e+00	·	3.3e+00	·
	(3.2e−01)	(2.7e−01)		(3.2e−01)		(2.8e−01)	
f_{17}	1.9e+03	1.8e+03	−	6.8e+02	−	2.3e+03	+
	(1.6e+02)	(9.8e+01)		(1.0e+02)		(1.3e+02)	
f_{18}	1.9e+03	1.8e+03	−	7.6e+02	−	2.3e+03	+
	(1.5e+02)	(1.1e+02)		(1.1e+02)		(1.1e+02)	
f_{19}	8.6e+04	5.9e+04	−	6.0e+03	−	9.7e+04	·
	(3.1e+04)	(1.6e+04)		(1.1e+04)		(3.0e+04)	
f_{20}	2.4e+01	2.4e+01	·	2.3e+01	−	2.4e+01	·
	(1.9e−01)	(2.1e−01)		(5.9e−01)		(2.2e−01)	
f_{21}	3.3e+03	3.2e+03	·	2.4e+03	−	3.5e+03	+
	(2.2e+02)	(1.7e+02)		(7.4e+02)		(1.7e+02)	
f_{22}	1.4e+04	1.2e+04	−	4.4e+03	−	1.4e+04	·
	(3.3e+02)	(4.2e+02)		(6.9e+02)		(3.6e+02)	
f_{23}	1.5e+04	1.5e+04	·	1.5e+04	·	1.5e+04	·
	(3.6e+02)	(3.6e+02)		(5.9e+02)		(4.0e+02)	
f_{24}	4.2e+02	4.1e+02	−	3.4e+02	−	4.2e+02	+
	(5.6e+00)	(4.2e+00)		(1.2e+01)		(5.5e+00)	
f_{25}	4.6e+02	4.5e+02	−	3.6e+02	−	4.7e+02	+
	(5.7e+00)	(5.9e+00)		(1.2e+01)		(6.1e+00)	
f_{26}	3.8e+02	3.5e+02	·	2.4e+02	−	4.1e+02	+
	(3.3e+01)	(4.0e+01)		(8.3e+01)		(2.5e+01)	
f_{27}	2.3e+03	2.3e+03	−	1.6e+03	−	2.3e+03	·
	(3.7e+01)	(4.6e+01)		(1.5e+02)		(4.2e+01)	
f_{28}	4.0e+03	3.6e+03	−	2.3e+03	·	4.3e+03	+
	(3.2e+02)	(2.8e+02)		(1.4e+03)		(2.8e+02)	
Summary (+/·/−)		0/14/14		0/5/23		14/14/0	

Table 233: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	4.4e+01	+	0.0e+00	·	4.3e−08	+
	(0.0e+00)	(3.1e+01)		(0.0e+00)		(3.6e−08)	
f_2	5.6e+06	2.5e+07	+	5.5e+06	·	1.5e+07	+
	(1.9e+06)	(1.1e+07)		(1.9e+06)		(5.1e+06)	
f_3	7.6e+08	7.6e+09	+	6.3e+08	·	8.3e+09	+
	(7.0e+08)	(5.0e+09)		(6.2e+08)		(4.2e+09)	
f_4	3.5e+04	6.7e+04	+	3.5e+04	·	4.2e+04	+
	(7.8e+03)	(9.5e+03)		(6.6e+03)		(6.1e+03)	
f_5	1.5e−08	1.6e+02	+	1.3e−08	·	3.7e−05	+
	(1.6e−08)	(2.0e+02)		(1.6e−08)		(3.1e−05)	
f_6	4.6e+01	5.2e+01	+	4.5e+01	·	4.4e+01	·
	(9.2e+00)	(6.4e+00)		(7.0e+00)		(1.7e+00)	
f_7	7.8e+01	4.8e+01	−	8.2e+01	·	9.8e+01	+
	(2.5e+01)	(1.4e+01)		(2.8e+01)		(2.4e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.2e−02)	(3.7e−02)		(3.2e−02)		(3.9e−02)	
f_9	2.5e+01	3.0e+01	+	2.5e+01	·	5.7e+01	+
	(4.6e+00)	(4.5e+00)		(4.7e+00)		(1.4e+01)	
f_{10}	2.8e−02	1.2e+02	+	2.7e−02	·	1.1e+00	+
	(1.6e−02)	(7.3e+01)		(1.9e−02)		(9.1e−02)	
f_{11}	1.7e+02	1.3e+02	−	1.5e+02	·	4.1e+02	+
	(4.4e+01)	(2.8e+01)		(3.7e+01)		(2.5e+01)	
f_{12}	1.4e+02	2.4e+02	·	1.4e+02	·	4.3e+02	+
	(3.6e+01)	(1.1e+02)		(4.3e+01)		(3.2e+01)	
f_{13}	3.6e+02	3.0e+02	−	3.7e+02	·	4.3e+02	+
	(7.9e+01)	(5.8e+01)		(7.1e+01)		(2.0e+01)	
f_{14}	3.8e+03	6.7e+03	+	3.5e+03	·	1.3e+04	+
	(6.9e+02)	(7.1e+02)		(6.7e+02)		(4.1e+02)	
f_{15}	1.2e+04	1.2e+04	·	1.3e+04	·	1.4e+04	+
	(2.6e+03)	(1.1e+03)		(1.7e+03)		(5.2e+02)	
f_{16}	3.2e+00	3.4e+00	·	3.3e+00	·	3.4e+00	·
	(2.9e−01)	(2.2e−01)		(2.5e−01)		(2.3e−01)	
f_{17}	2.3e+02	3.0e+02	+	2.3e+02	·	4.7e+02	+
	(3.6e+01)	(1.7e+01)		(3.3e+01)		(2.6e+01)	
f_{18}	4.7e+02	3.9e+02	−	4.7e+02	·	4.9e+02	+
	(2.9e+01)	(1.4e+01)		(3.4e+01)		(3.2e+01)	
f_{19}	1.0e+01	5.6e+01	+	1.0e+01	·	3.5e+01	+
	(3.1e+00)	(2.2e+02)		(2.9e+00)		(2.1e+00)	
f_{20}	2.2e+01	2.1e+01	−	2.2e+01	·	2.2e+01	·
	(4.3e−01)	(3.5e−01)		(3.3e−01)		(3.2e−01)	
f_{21}	8.4e+02	7.3e+02	·	7.6e+02	·	8.7e+02	+
	(3.6e+02)	(4.1e+02)		(4.2e+02)		(3.6e+02)	
f_{22}	4.4e+03	6.5e+03	+	4.5e+03	·	1.4e+04	+
	(8.2e+02)	(7.2e+02)		(7.7e+02)		(4.2e+02)	
f_{23}	1.2e+04	1.0e+04	·	1.1e+04	·	1.4e+04	+
	(2.0e+03)	(2.1e+03)		(2.7e+03)		(5.2e+02)	
f_{24}	2.8e+02	2.8e+02	·	2.8e+02	·	2.9e+02	·
	(1.4e+01)	(1.2e+01)		(9.6e+00)		(1.7e+01)	
f_{25}	3.1e+02	3.2e+02	+	3.1e+02	·	3.1e+02	·
	(1.2e+01)	(9.4e+00)		(1.1e+01)		(1.2e+01)	
f_{26}	3.6e+02	2.5e+02	−	3.6e+02	·	3.8e+02	+
	(4.1e+01)	(8.0e+01)		(4.0e+01)		(5.1e+01)	
f_{27}	1.0e+03	1.1e+03	·	1.1e+03	·	1.2e+03	·
	(1.2e+02)	(1.1e+02)		(1.1e+02)		(2.3e+02)	
f_{28}	1.3e+03	6.4e+02	·	1.3e+03	·	1.1e+03	+
	(1.4e+03)	(6.2e+02)		(1.4e+03)		(1.4e+03)	
Summary (+/·/−)		13/9/6		0/28/0		21/7/0	

Table 234: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.9e+04	7.3e+02	−	1.6e+02	−	2.5e+04	+
	(2.6e+03)	(1.1e+02)		(2.7e+02)		(2.6e+03)	
f_2	4.0e+08	2.7e+08	−	1.6e+07	−	4.4e+08	·
	(6.5e+07)	(3.4e+07)		(6.1e+06)		(7.5e+07)	
f_3	1.0e+11	5.1e+10	−	6.7e+09	−	1.1e+11	·
	(1.5e+10)	(4.5e+09)		(3.5e+09)		(1.2e+10)	
f_4	9.6e+04	1.1e+05	+	9.1e+04	·	9.4e+04	·
	(1.3e+04)	(1.1e+04)		(1.3e+04)		(9.2e+03)	
f_5	1.5e+03	1.5e+02	−	1.9e+01	−	1.6e+03	·
	(2.5e+02)	(1.7e+01)		(2.6e+01)		(2.3e+02)	
f_6	1.3e+03	1.4e+02	−	7.0e+01	−	1.7e+03	+
	(1.9e+02)	(1.4e+01)		(3.5e+01)		(2.7e+02)	
f_7	2.0e+02	1.5e+02	−	7.7e+01	−	2.0e+02	·
	(1.3e+01)	(6.8e+00)		(1.6e+01)		(1.1e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.7e−02)	(4.1e−02)		(4.1e−02)		(4.1e−02)	
f_9	7.2e+01	7.3e+01	·	4.6e+01	−	7.3e+01	·
	(1.3e+00)	(1.3e+00)		(1.0e+01)		(1.4e+00)	
f_{10}	3.1e+03	6.6e+02	−	6.8e+01	−	3.5e+03	+
	(4.1e+02)	(8.5e+01)		(5.8e+01)		(3.5e+02)	
f_{11}	6.6e+02	4.1e+02	−	1.1e+02	−	7.0e+02	+
	(3.6e+01)	(1.4e+01)		(2.1e+01)		(4.6e+01)	
f_{12}	7.1e+02	4.4e+02	−	1.7e+02	−	7.6e+02	+
	(4.9e+01)	(2.3e+01)		(3.6e+01)		(4.4e+01)	
f_{13}	7.1e+02	4.4e+02	−	3.3e+02	−	7.7e+02	+
	(5.0e+01)	(2.7e+01)		(7.2e+01)		(4.1e+01)	
f_{14}	1.3e+04	1.2e+04	−	2.5e+03	−	1.3e+04	·
	(6.0e+02)	(3.6e+02)		(5.6e+02)		(3.1e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.7e+02)	(3.3e+02)		(5.2e+02)		(3.6e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.4e+00	·	3.3e+00	·
	(2.3e−01)	(3.2e−01)		(2.5e−01)		(3.3e−01)	
f_{17}	1.5e+03	5.1e+02	−	2.8e+02	−	1.9e+03	+
	(1.4e+02)	(2.1e+01)		(6.4e+01)		(1.1e+02)	
f_{18}	1.6e+03	5.1e+02	−	3.8e+02	−	1.9e+03	+
	(1.7e+02)	(2.3e+01)		(8.6e+01)		(1.2e+02)	
f_{19}	1.5e+04	5.6e+01	−	4.3e+01	−	2.9e+04	+
	(7.6e+03)	(4.8e+00)		(7.7e+01)		(1.1e+04)	
f_{20}	2.3e+01	2.3e+01	−	2.3e+01	−	2.3e+01	·
	(2.8e−01)	(2.3e−01)		(4.7e−01)		(3.0e−01)	
f_{21}	3.1e+03	6.7e+02	−	8.8e+02	−	3.7e+03	+
	(8.1e+02)	(3.7e+01)		(3.7e+02)		(8.2e+02)	
f_{22}	1.3e+04	1.3e+04	−	2.8e+03	−	1.4e+04	+
	(3.9e+02)	(3.7e+02)		(6.5e+02)		(3.2e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.7e+02)	(3.3e+02)		(7.5e+02)		(4.7e+02)	
f_{24}	3.9e+02	3.7e+02	−	3.0e+02	−	4.0e+02	·
	(5.3e+00)	(6.4e+00)		(9.4e+00)		(6.3e+00)	
f_{25}	4.2e+02	4.3e+02	·	3.3e+02	−	4.3e+02	+
	(7.4e+00)	(4.8e+00)		(1.2e+01)		(6.6e+00)	
f_{26}	3.7e+02	2.7e+02	−	3.3e+02	·	3.6e+02	·
	(1.2e+02)	(8.1e+01)		(9.5e+01)		(1.2e+02)	
f_{27}	2.2e+03	2.2e+03	·	1.3e+03	−	2.2e+03	·
	(4.9e+01)	(4.9e+01)		(1.8e+02)		(5.4e+01)	
f_{28}	2.4e+03	6.2e+02	−	1.2e+03	−	2.7e+03	+
	(6.8e+02)	(2.4e+01)		(1.4e+03)		(2.4e+02)	
Summary (+/·/−)		1/7/20		0/6/22		13/15/0	

Table 235: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	2.3e+00	8.3e−01	−	2.2e−02	−	5.0e+01	+
	(4.9e−01)	(2.0e−01)		(1.3e−02)		(3.6e+00)	
f_2	1.0e+08	1.2e+08	+	1.4e+07	−	1.9e+08	+
	(1.4e+07)	(1.9e+07)		(5.5e+06)		(2.3e+07)	
f_3	1.5e+10	9.8e+09	−	3.5e+09	−	3.6e+10	+
	(2.1e+09)	(1.6e+09)		(1.8e+09)		(2.9e+09)	
f_4	9.1e+04	9.7e+04	·	7.7e+04	−	1.0e+05	+
	(1.0e+04)	(1.1e+04)		(1.1e+04)		(6.3e+03)	
f_5	2.2e+00	1.3e+00	−	3.0e−01	−	1.4e+01	+
	(3.4e−01)	(2.2e−01)		(1.1e−01)		(8.5e−01)	
f_6	4.7e+01	4.8e+01	·	4.9e+01	·	6.3e+01	+
	(2.0e−01)	(3.5e−01)		(8.7e+00)		(1.9e+00)	
f_7	9.7e+01	8.4e+01	−	8.0e+01	−	1.3e+02	+
	(5.3e+00)	(7.4e+00)		(1.7e+01)		(5.7e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.9e−02)	(4.3e−02)		(4.6e−02)		(3.5e−02)	
f_9	7.3e+01	7.2e+01	·	3.7e+01	−	7.3e+01	·
	(1.6e+00)	(1.4e+00)		(8.6e+00)		(1.4e+00)	
f_{10}	4.3e+01	4.0e+01	·	5.7e+00	−	5.9e+02	+
	(7.8e+00)	(1.0e+01)		(2.6e+00)		(6.3e+01)	
f_{11}	3.8e+02	3.5e+02	−	1.5e+02	−	4.2e+02	+
	(1.4e+01)	(1.4e+01)		(3.7e+01)		(1.5e+01)	
f_{12}	4.0e+02	3.9e+02	·	1.5e+02	−	4.7e+02	+
	(1.4e+01)	(1.4e+01)		(5.6e+01)		(1.2e+01)	
f_{13}	4.0e+02	4.0e+02	·	3.7e+02	·	4.6e+02	+
	(1.5e+01)	(1.5e+01)		(6.4e+01)		(1.7e+01)	
f_{14}	1.3e+04	1.2e+04	−	3.7e+03	−	1.3e+04	·
	(3.7e+02)	(3.9e+02)		(6.9e+02)		(4.0e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(2.9e+02)	(3.5e+02)		(6.6e+02)		(3.2e+02)	
f_{16}	3.3e+00	3.2e+00	·	3.3e+00	·	3.4e+00	·
	(2.6e−01)	(2.4e−01)		(2.6e−01)		(3.0e−01)	
f_{17}	4.4e+02	4.1e+02	−	2.5e+02	−	5.2e+02	+
	(1.4e+01)	(1.5e+01)		(3.2e+01)		(1.7e+01)	
f_{18}	4.6e+02	4.4e+02	−	4.6e+02	·	5.4e+02	+
	(1.5e+01)	(1.6e+01)		(2.7e+01)		(1.5e+01)	
f_{19}	3.5e+01	3.4e+01	−	1.3e+01	−	4.9e+01	+
	(1.6e+00)	(1.4e+00)		(3.0e+00)		(1.9e+00)	
f_{20}	2.3e+01	2.3e+01	·	2.3e+01	·	2.3e+01	·
	(2.3e−01)	(2.3e−01)		(3.0e−01)		(1.7e−01)	
f_{21}	2.3e+02	2.2e+02	−	7.1e+02	·	3.2e+02	+
	(2.9e+00)	(2.3e+00)		(4.5e+02)		(5.3e+00)	
f_{22}	1.4e+04	1.2e+04	−	4.1e+03	−	1.4e+04	·
	(3.8e+02)	(4.0e+02)		(5.8e+02)		(3.3e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.1e+02)	(3.6e+02)		(7.7e+02)		(3.6e+02)	
f_{24}	2.9e+02	3.0e+02	+	2.9e+02	−	3.6e+02	+
	(7.0e+00)	(1.2e+01)		(1.2e+01)		(5.3e+00)	
f_{25}	4.3e+02	4.0e+02	−	3.1e+02	−	4.2e+02	−
	(5.1e+00)	(1.4e+01)		(1.3e+01)		(4.4e+00)	
f_{26}	2.5e+02	2.4e+02	·	3.5e+02	+	4.5e+02	+
	(7.8e+01)	(7.6e+01)		(7.6e+01)		(4.1e+01)	
f_{27}	2.0e+03	2.0e+03	·	1.2e+03	−	2.1e+03	+
	(1.0e+02)	(1.2e+02)		(1.0e+02)		(5.1e+01)	
f_{28}	4.1e+02	4.1e+02	−	9.5e+02	−	4.5e+02	+
	(9.5e−01)	(9.6e−01)		(1.2e+03)		(2.7e+00)	
Summary (+/·/−)		2/13/13		1/9/18		19/8/1	

Table 236: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	2.8e−05	·	0.0e+00	·	5.2e−02	+
	(0.0e+00)	(1.7e−04)		(0.0e+00)		(3.2e−02)	
f_2	4.3e+06	6.0e+06	+	9.1e+06	+	3.9e+07	+
	(1.2e+06)	(2.7e+06)		(3.5e+06)		(1.4e+07)	
f_3	2.2e+07	4.1e+08	+	1.1e+09	+	2.8e+10	+
	(3.6e+07)	(1.1e+09)		(9.6e+08)		(7.8e+09)	
f_4	2.9e+04	4.6e+04	+	4.5e+04	+	5.5e+04	+
	(5.4e+03)	(7.9e+03)		(7.8e+03)		(9.3e+03)	
f_5	0.0e+00	1.2e+01	+	7.7e−06	+	3.2e−01	+
	(0.0e+00)	(1.8e+01)		(8.3e−06)		(2.4e−01)	
f_6	4.3e+01	4.8e+01	+	4.4e+01	+	4.5e+01	+
	(9.8e+00)	(1.2e+00)		(8.6e−01)		(1.1e+00)	
f_7	3.9e+01	1.4e+01	−	7.8e+01	+	1.2e+02	+
	(2.2e+01)	(6.0e+00)		(2.6e+01)		(1.9e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.8e−02)	(4.8e−02)		(2.9e−02)		(4.1e−02)	
f_9	2.9e+01	2.0e+01	·	2.5e+01	·	6.7e+01	+
	(1.8e+01)	(8.2e+00)		(4.6e+00)		(7.0e+00)	
f_{10}	2.4e−02	1.9e+01	+	8.5e−02	+	3.8e+01	+
	(1.6e−02)	(1.2e+01)		(6.4e−02)		(1.7e+01)	
f_{11}	3.4e+02	1.7e+02	−	1.5e+02	−	4.3e+02	+
	(7.3e+01)	(2.6e+01)		(3.6e+01)		(2.3e+01)	
f_{12}	3.9e+02	2.9e+02	−	1.4e+02	−	4.7e+02	+
	(2.5e+01)	(5.6e+01)		(3.5e+01)		(3.2e+01)	
f_{13}	4.0e+02	3.0e+02	−	3.8e+02	·	4.7e+02	+
	(2.0e+01)	(5.0e+01)		(6.3e+01)		(2.5e+01)	
f_{14}	1.3e+04	1.1e+04	−	3.7e+03	−	1.3e+04	·
	(4.2e+02)	(4.1e+02)		(6.1e+02)		(4.9e+02)	
f_{15}	1.4e+04	1.4e+04	−	1.3e+04	−	1.4e+04	·
	(4.0e+02)	(3.5e+02)		(1.8e+03)		(4.5e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.4e+00	·	3.3e+00	·
	(3.1e−01)	(2.7e−01)		(2.4e−01)		(3.1e−01)	
f_{17}	4.3e+02	3.2e+02	−	2.4e+02	−	5.1e+02	+
	(1.6e+01)	(1.5e+01)		(5.2e+01)		(3.1e+01)	
f_{18}	4.4e+02	3.7e+02	−	4.5e+02	·	5.3e+02	+
	(2.0e+01)	(1.3e+01)		(2.9e+01)		(2.0e+01)	
f_{19}	3.2e+01	1.9e+01	−	1.0e+01	−	3.9e+01	+
	(2.0e+00)	(3.8e+00)		(2.8e+00)		(1.9e+00)	
f_{20}	2.2e+01	2.2e+01	−	2.2e+01	+	2.3e+01	+
	(3.0e−01)	(3.2e−01)		(2.9e−01)		(3.5e−01)	
f_{21}	8.3e+02	5.2e+02	·	7.2e+02	·	8.2e+02	+
	(3.7e+02)	(4.3e+02)		(4.3e+02)		(4.0e+02)	
f_{22}	1.3e+04	1.0e+04	−	4.6e+03	−	1.4e+04	·
	(3.6e+02)	(4.4e+02)		(7.8e+02)		(5.1e+02)	
f_{23}	1.4e+04	1.3e+04	−	1.3e+04	−	1.4e+04	·
	(5.3e+02)	(4.0e+02)		(2.0e+03)		(5.1e+02)	
f_{24}	2.6e+02	2.4e+02	−	2.8e+02	+	3.2e+02	+
	(1.1e+01)	(1.1e+01)		(1.1e+01)		(2.2e+01)	
f_{25}	3.0e+02	2.9e+02	−	3.0e+02	+	3.2e+02	+
	(8.7e+00)	(6.9e+00)		(1.1e+01)		(1.4e+01)	
f_{26}	3.3e+02	2.4e+02	−	3.4e+02	+	4.2e+02	+
	(5.5e+01)	(6.4e+01)		(6.1e+01)		(7.5e+01)	
f_{27}	8.4e+02	7.9e+02	·	1.0e+03	+	1.7e+03	+
	(8.5e+01)	(7.4e+01)		(1.1e+02)		(2.1e+02)	
f_{28}	6.9e+02	4.6e+02	−	1.0e+03	+	9.2e+02	+
	(9.0e+02)	(4.1e+02)		(1.2e+03)		(1.2e+03)	
Summary (+/·/−)		6/6/16		13/7/8		22/6/0	

Table 237: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	3.6e+03	6.9e+02	−	1.5e+02	−	9.5e+03	+
	(5.8e+02)	(1.0e+02)		(2.6e+02)		(6.2e+02)	
f_2	3.8e+08	2.7e+08	−	1.5e+07	−	4.1e+08	·
	(5.3e+07)	(4.4e+07)		(7.2e+06)		(4.3e+07)	
f_3	6.7e+10	5.1e+10	−	6.4e+09	−	8.2e+10	+
	(6.5e+09)	(4.4e+09)		(3.3e+09)		(6.8e+09)	
f_4	1.2e+05	1.1e+05	·	9.3e+04	−	1.2e+05	·
	(9.7e+03)	(1.5e+04)		(1.2e+04)		(9.3e+03)	
f_5	3.6e+02	1.5e+02	−	1.5e+01	−	4.1e+02	+
	(4.1e+01)	(1.6e+01)		(1.8e+01)		(2.8e+01)	
f_6	3.4e+02	1.3e+02	−	7.0e+01	−	8.3e+02	+
	(4.5e+01)	(1.1e+01)		(3.1e+01)		(7.3e+01)	
f_7	1.7e+02	1.5e+02	−	7.9e+01	−	1.8e+02	+
	(9.8e+00)	(7.0e+00)		(1.9e+01)		(7.5e+00)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.2e−02)	(4.0e−02)		(4.3e−02)		(4.0e−02)	
f_9	7.3e+01	7.3e+01	·	4.2e+01	−	7.3e+01	·
	(1.4e+00)	(1.7e+00)		(6.3e+00)		(1.2e+00)	
f_{10}	1.7e+03	6.5e+02	−	7.7e+01	−	2.6e+03	+
	(2.0e+02)	(9.4e+01)		(8.4e+01)		(2.0e+02)	
f_{11}	4.7e+02	4.1e+02	−	1.1e+02	−	5.3e+02	+
	(1.7e+01)	(1.6e+01)		(2.3e+01)		(2.3e+01)	
f_{12}	5.2e+02	4.4e+02	−	1.8e+02	−	6.2e+02	+
	(2.4e+01)	(2.1e+01)		(4.6e+01)		(2.2e+01)	
f_{13}	5.2e+02	4.5e+02	−	3.5e+02	−	6.2e+02	+
	(2.8e+01)	(1.9e+01)		(7.6e+01)		(2.1e+01)	
f_{14}	1.3e+04	1.2e+04	−	2.5e+03	−	1.3e+04	·
	(3.1e+02)	(4.0e+02)		(5.7e+02)		(3.7e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.3e+02)	(3.8e+02)		(5.1e+02)		(2.4e+02)	
f_{16}	3.4e+00	3.3e+00	·	3.3e+00	·	3.3e+00	·
	(2.8e−01)	(3.0e−01)		(3.2e−01)		(2.3e−01)	
f_{17}	6.9e+02	5.1e+02	−	2.9e+02	−	1.1e+03	+
	(3.7e+01)	(2.0e+01)		(5.8e+01)		(5.1e+01)	
f_{18}	6.9e+02	5.1e+02	−	3.8e+02	−	1.1e+03	+
	(3.2e+01)	(2.2e+01)		(9.8e+01)		(5.0e+01)	
f_{19}	2.5e+02	5.5e+01	−	4.0e+01	−	3.0e+03	+
	(7.0e+01)	(4.1e+00)		(1.1e+02)		(7.5e+02)	
f_{20}	2.3e+01	2.3e+01	·	2.3e+01	−	2.3e+01	·
	(1.9e−01)	(2.0e−01)		(3.6e−01)		(2.4e−01)	
f_{21}	1.2e+03	6.6e+02	−	9.1e+02	·	1.7e+03	+
	(6.9e+01)	(3.3e+01)		(4.3e+02)		(4.8e+01)	
f_{22}	1.4e+04	1.3e+04	−	2.8e+03	−	1.4e+04	·
	(3.5e+02)	(4.8e+02)		(5.5e+02)		(3.1e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.4e+02)	(3.1e+02)		(4.9e+02)		(3.9e+02)	
f_{24}	3.8e+02	3.7e+02	−	3.0e+02	−	3.9e+02	+
	(5.5e+00)	(8.4e+00)		(1.0e+01)		(4.5e+00)	
f_{25}	4.3e+02	4.3e+02	·	3.2e+02	−	4.4e+02	+
	(3.9e+00)	(5.1e+00)		(1.0e+01)		(3.8e+00)	
f_{26}	2.9e+02	2.9e+02	·	3.3e+02	·	4.4e+02	+
	(8.3e+01)	(9.4e+01)		(9.3e+01)		(3.6e+01)	
f_{27}	2.2e+03	2.2e+03	·	1.3e+03	−	2.2e+03	+
	(5.3e+01)	(4.2e+01)		(1.1e+02)		(4.9e+01)	
f_{28}	9.9e+02	6.2e+02	−	9.4e+02	−	1.4e+03	+
	(4.7e+01)	(2.1e+01)		(1.2e+03)		(6.9e+01)	
Summary (+/·/−)		0/10/18		0/6/22		18/10/0	

Table 238: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.7}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	0.0e+00	1.3e−01	+	1.0e−02	+	2.2e+04	+
	(0.0e+00)	(3.4e−02)		(6.2e−03)		(3.5e+03)	
f_2	1.4e+07	1.1e+08	+	1.4e+07	·	3.2e+08	+
	(3.1e+06)	(1.8e+07)		(6.2e+06)		(6.7e+07)	
f_3	2.7e+06	5.8e+09	+	3.6e+09	+	1.1e+11	+
	(4.1e+06)	(8.7e+08)		(2.4e+09)		(1.3e+10)	
f_4	4.0e+04	9.0e+04	+	7.2e+04	+	8.8e+04	+
	(6.8e+03)	(1.2e+04)		(9.5e+03)		(1.2e+04)	
f_5	1.8e−06	4.2e−01	+	2.1e−01	+	1.3e+03	+
	(7.7e−07)	(8.0e−02)		(9.1e−02)		(3.1e+02)	
f_6	4.4e+01	4.7e+01	+	4.8e+01	+	1.4e+03	+
	(8.0e−01)	(3.8e−01)		(6.3e+00)		(3.4e+02)	
f_7	1.1e+01	7.4e+01	+	8.2e+01	+	2.1e+02	+
	(3.9e+00)	(7.6e+00)		(1.7e+01)		(1.9e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.7e−02)	(3.6e−02)		(3.5e−02)		(3.8e−02)	
f_9	7.3e+01	7.2e+01	·	3.4e+01	−	7.2e+01	·
	(1.3e+00)	(1.4e+00)		(7.1e+00)		(1.8e+00)	
f_{10}	2.2e−02	2.1e+01	+	4.4e+00	+	3.0e+03	+
	(2.2e−02)	(4.3e+00)		(1.5e+00)		(3.9e+02)	
f_{11}	3.6e+02	3.4e+02	−	1.5e+02	−	7.0e+02	+
	(1.3e+01)	(1.4e+01)		(3.2e+01)		(5.5e+01)	
f_{12}	3.8e+02	3.8e+02	·	1.4e+02	−	7.6e+02	+
	(1.3e+01)	(1.9e+01)		(6.0e+01)		(6.6e+01)	
f_{13}	3.7e+02	3.8e+02	·	3.8e+02	·	7.5e+02	+
	(1.5e+01)	(1.7e+01)		(5.0e+01)		(5.5e+01)	
f_{14}	1.3e+04	1.2e+04	−	3.7e+03	−	1.3e+04	·
	(3.9e+02)	(4.7e+02)		(5.7e+02)		(4.3e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.0e+02)	(3.9e+02)		(6.2e+02)		(3.6e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.3e+00	·	3.3e+00	·
	(2.8e−01)	(3.6e−01)		(2.5e−01)		(3.4e−01)	
f_{17}	4.2e+02	4.0e+02	−	2.5e+02	−	1.8e+03	+
	(1.4e+01)	(1.6e+01)		(4.0e+01)		(2.0e+02)	
f_{18}	4.3e+02	4.4e+02	·	4.6e+02	+	1.9e+03	+
	(1.4e+01)	(1.5e+01)		(2.7e+01)		(1.4e+02)	
f_{19}	3.2e+01	3.3e+01	+	1.3e+01	−	2.5e+04	+
	(1.6e+00)	(1.3e+00)		(3.1e+00)		(1.6e+04)	
f_{20}	2.2e+01	2.3e+01	+	2.3e+01	+	2.3e+01	+
	(2.1e−01)	(2.2e−01)		(2.7e−01)		(2.8e−01)	
f_{21}	6.2e+02	2.1e+02	·	6.7e+02	·	3.6e+03	+
	(4.4e+02)	(8.7e−01)		(4.5e+02)		(7.8e+02)	
f_{22}	1.3e+04	1.2e+04	−	3.9e+03	−	1.4e+04	+
	(3.6e+02)	(4.2e+02)		(6.3e+02)		(4.1e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	+
	(3.3e+02)	(3.4e+02)		(9.4e+02)		(3.4e+02)	
f_{24}	2.2e+02	2.8e+02	+	2.9e+02	+	3.9e+02	+
	(1.9e+01)	(1.2e+01)		(1.2e+01)		(8.4e+00)	
f_{25}	2.9e+02	3.8e+02	+	3.1e+02	+	4.1e+02	+
	(1.2e+01)	(1.9e+01)		(1.1e+01)		(1.2e+01)	
f_{26}	3.5e+02	2.4e+02	·	3.5e+02	·	4.1e+02	+
	(1.0e+02)	(8.8e+01)		(6.7e+01)		(1.1e+02)	
f_{27}	8.3e+02	1.9e+03	+	1.1e+03	+	2.2e+03	+
	(3.4e+02)	(1.4e+02)		(1.2e+02)		(6.9e+01)	
f_{28}	6.9e+02	4.0e+02	+	8.3e+02	+	2.8e+03	+
	(9.0e+02)	(3.8e−01)		(1.1e+03)		(1.0e+03)	
Summary (+/·/−)		14/10/4		13/8/7		23/5/0	

Table 239: Comparison of **DE/rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.4e+04	1.3e+04	·	3.8e+03	−	3.2e+04	+
	(1.6e+03)	(1.4e+03)		(1.8e+03)		(2.4e+03)	
f_2	5.5e+08	5.8e+08	·	3.2e+07	−	6.6e+08	+
	(7.2e+07)	(7.8e+07)		(1.7e+07)		(8.6e+07)	
f_3	1.2e+11	1.2e+11	·	1.5e+10	−	1.5e+11	+
	(9.6e+09)	(9.1e+09)		(6.7e+09)		(1.3e+10)	
f_4	1.3e+05	1.3e+05	·	1.1e+05	−	1.3e+05	·
	(1.0e+04)	(9.6e+03)		(1.0e+04)		(1.1e+04)	
f_5	1.9e+03	1.9e+03	·	5.4e+02	−	2.8e+03	+
	(2.1e+02)	(2.4e+02)		(3.7e+02)		(2.6e+02)	
f_6	9.6e+02	9.1e+02	·	3.0e+02	−	2.5e+03	+
	(1.2e+02)	(1.1e+02)		(8.2e+01)		(2.4e+02)	
f_7	2.1e+02	2.1e+02	·	1.1e+02	−	2.4e+02	+
	(1.1e+01)	(1.2e+01)		(2.3e+01)		(1.5e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.2e−02)	(3.9e−02)		(3.6e−02)		(3.7e−02)	
f_9	7.3e+01	7.3e+01	·	5.8e+01	−	7.3e+01	·
	(1.4e+00)	(1.2e+00)		(8.2e+00)		(1.4e+00)	
f_{10}	3.6e+03	3.4e+03	·	7.5e+02	−	5.1e+03	+
	(3.8e+02)	(4.4e+02)		(3.2e+02)		(5.0e+02)	
f_{11}	5.9e+02	5.8e+02	·	2.5e+02	−	7.8e+02	+
	(2.8e+01)	(2.7e+01)		(4.3e+01)		(3.7e+01)	
f_{12}	6.4e+02	6.5e+02	·	3.7e+02	−	8.5e+02	+
	(2.7e+01)	(3.4e+01)		(6.0e+01)		(3.2e+01)	
f_{13}	6.5e+02	6.5e+02	·	3.9e+02	−	8.5e+02	+
	(3.5e+01)	(3.0e+01)		(4.1e+01)		(2.6e+01)	
f_{14}	1.2e+04	1.2e+04	·	4.1e+03	−	1.3e+04	+
	(3.5e+02)	(4.5e+02)		(6.2e+02)		(3.4e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.1e+02)	(3.4e+02)		(5.4e+02)		(3.6e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.4e+00	·	3.4e+00	·
	(3.5e−01)	(2.6e−01)		(2.9e−01)		(2.6e−01)	
f_{17}	1.1e+03	1.0e+03	·	5.7e+02	−	2.0e+03	+
	(5.6e+01)	(6.9e+01)		(1.1e+02)		(1.2e+02)	
f_{18}	1.1e+03	1.0e+03	·	6.1e+02	−	2.1e+03	+
	(6.2e+01)	(8.5e+01)		(8.0e+01)		(1.0e+02)	
f_{19}	4.8e+03	4.9e+03	·	1.5e+03	−	5.1e+04	+
	(1.6e+03)	(1.4e+03)		(3.3e+03)		(1.6e+04)	
f_{20}	2.4e+01	2.4e+01	·	2.3e+01	−	2.4e+01	+
	(3.1e−01)	(2.5e−01)		(5.7e−01)		(2.2e−01)	
f_{21}	2.1e+03	2.1e+03	·	1.9e+03	·	3.1e+03	+
	(1.1e+02)	(1.0e+02)		(6.0e+02)		(1.3e+02)	
f_{22}	1.3e+04	1.3e+04	·	4.5e+03	−	1.4e+04	+
	(4.7e+02)	(4.9e+02)		(6.8e+02)		(3.4e+02)	
f_{23}	1.5e+04	1.5e+04	·	1.5e+04	·	1.5e+04	·
	(3.6e+02)	(2.9e+02)		(4.1e+02)		(3.2e+02)	
f_{24}	4.0e+02	4.0e+02	·	3.3e+02	−	4.1e+02	+
	(5.7e+00)	(4.7e+00)		(1.4e+01)		(4.1e+00)	
f_{25}	4.4e+02	4.4e+02	·	3.4e+02	−	4.6e+02	+
	(4.2e+00)	(5.3e+00)		(1.3e+01)		(6.1e+00)	
f_{26}	3.4e+02	3.5e+02	·	2.4e+02	−	4.1e+02	+
	(4.4e+01)	(4.8e+01)		(8.5e+01)		(3.3e+01)	
f_{27}	2.3e+03	2.3e+03	·	1.5e+03	−	2.3e+03	+
	(3.6e+01)	(4.9e+01)		(1.6e+02)		(5.6e+01)	
f_{28}	2.1e+03	2.1e+03	·	1.6e+03	−	3.5e+03	+
	(1.6e+02)	(1.6e+02)		(1.2e+03)		(1.8e+02)	
Summary (+/·/−)		0/28/0		0/5/23		22/6/0	

Table 240: Comparison of **DE/rand/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/rand/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	6.1e+04	5.3e+04	−	1.2e+04	−	6.3e+04	·
	(3.9e+03)	(4.2e+03)		(3.5e+03)		(4.3e+03)	
f_2	9.4e+08	9.0e+08	·	1.7e+08	−	9.5e+08	·
	(1.4e+08)	(1.4e+08)		(6.5e+07)		(1.4e+08)	
f_3	4.1e+11	2.5e+11	−	5.6e+10	−	4.4e+11	·
	(2.6e+11)	(6.1e+10)		(1.9e+10)		(2.1e+11)	
f_4	1.4e+05	1.4e+05	·	1.2e+05	−	1.4e+05	·
	(9.3e+03)	(9.7e+03)		(1.2e+04)		(9.9e+03)	
f_5	9.7e+03	8.7e+03	·	2.4e+03	−	9.2e+03	·
	(1.0e+03)	(1.3e+03)		(1.1e+03)		(1.0e+03)	
f_6	5.6e+03	4.9e+03	−	8.3e+02	−	6.0e+03	·
	(6.9e+02)	(5.8e+02)		(3.1e+02)		(7.7e+02)	
f_7	3.9e+02	3.3e+02	−	1.6e+02	−	4.6e+02	·
	(6.7e+01)	(3.7e+01)		(2.5e+01)		(1.2e+02)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.9e−02)	(3.3e−02)		(3.9e−02)		(4.3e−02)	
f_9	7.3e+01	7.3e+01	·	6.4e+01	−	7.3e+01	·
	(1.2e+00)	(1.6e+00)		(5.6e+00)		(1.5e+00)	
f_{10}	8.1e+03	7.8e+03	·	2.1e+03	−	8.3e+03	·
	(6.1e+02)	(6.1e+02)		(5.9e+02)		(8.1e+02)	
f_{11}	1.1e+03	1.0e+03	−	3.8e+02	−	1.1e+03	·
	(5.0e+01)	(6.1e+01)		(6.1e+01)		(5.5e+01)	
f_{12}	1.1e+03	1.1e+03	−	5.7e+02	−	1.2e+03	·
	(5.7e+01)	(4.1e+01)		(7.4e+01)		(6.1e+01)	
f_{13}	1.1e+03	1.1e+03	−	5.6e+02	−	1.2e+03	·
	(5.7e+01)	(6.0e+01)		(5.2e+01)		(5.0e+01)	
f_{14}	1.3e+04	1.2e+04	−	4.1e+03	−	1.3e+04	·
	(3.3e+02)	(3.5e+02)		(5.1e+02)		(3.3e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.0e+02)	(3.6e+02)		(4.4e+02)		(4.6e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.3e+00	·	3.4e+00	·
	(2.7e−01)	(3.0e−01)		(2.6e−01)		(2.9e−01)	
f_{17}	2.7e+03	2.4e+03	−	8.7e+02	−	2.8e+03	·
	(1.6e+02)	(1.5e+02)		(1.3e+02)		(1.0e+02)	
f_{18}	2.7e+03	2.5e+03	−	9.5e+02	−	2.8e+03	·
	(1.6e+02)	(1.3e+02)		(1.2e+02)		(1.2e+02)	
f_{19}	4.1e+05	3.7e+05	·	1.5e+04	−	4.2e+05	·
	(1.3e+05)	(8.8e+04)		(1.8e+04)		(1.1e+05)	
f_{20}	2.5e+01	2.5e+01	·	2.3e+01	−	2.5e+01	·
	(1.5e−01)	(1.9e−01)		(5.8e−01)		(1.6e−01)	
f_{21}	5.2e+03	5.3e+03	·	3.1e+03	−	5.2e+03	·
	(3.4e+02)	(3.4e+02)		(7.3e+02)		(2.9e+02)	
f_{22}	1.4e+04	1.4e+04	−	4.6e+03	−	1.5e+04	·
	(3.6e+02)	(4.1e+02)		(7.4e+02)		(2.8e+02)	
f_{23}	1.5e+04	1.5e+04	·	1.5e+04	−	1.5e+04	·
	(3.5e+02)	(3.8e+02)		(4.9e+02)		(3.4e+02)	
f_{24}	4.4e+02	4.2e+02	−	3.6e+02	−	4.4e+02	+
	(4.9e+00)	(5.9e+00)		(1.4e+01)		(6.9e+00)	
f_{25}	4.8e+02	4.6e+02	−	3.8e+02	−	4.9e+02	+
	(5.8e+00)	(6.4e+00)		(1.3e+01)		(7.5e+00)	
f_{26}	3.9e+02	3.6e+02	−	2.3e+02	−	3.8e+02	·
	(3.2e+01)	(2.9e+01)		(5.6e+01)		(3.2e+01)	
f_{27}	2.4e+03	2.3e+03	−	1.8e+03	−	2.4e+03	·
	(5.3e+01)	(3.8e+01)		(9.0e+01)		(4.3e+01)	
f_{28}	6.5e+03	6.3e+03	·	2.8e+03	−	6.7e+03	·
	(3.5e+02)	(4.6e+02)		(1.2e+03)		(4.0e+02)	
Summary (+/·/−)		0/13/15		0/3/25		2/26/0	

Table 241: Comparison of **DE/best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	6.7e−02	4.7e+00	+	5.7e−02	·	1.1e+04	+
	(1.3e−01)	(9.9e−01)		(3.9e−02)		(1.6e+03)	
f_2	1.5e+07	1.4e+08	+	1.4e+07	·	2.9e+08	+
	(6.4e+06)	(2.2e+07)		(5.1e+06)		(5.1e+07)	
f_3	3.4e+09	1.5e+10	+	3.5e+09	·	8.2e+10	+
	(1.6e+09)	(2.2e+09)		(1.7e+09)		(9.3e+09)	
f_4	8.0e+04	9.6e+04	+	7.8e+04	·	8.4e+04	·
	(8.7e+03)	(1.1e+04)		(1.2e+04)		(8.1e+03)	
f_5	6.1e−01	4.2e+00	+	5.2e−01	·	4.8e+02	+
	(2.6e−01)	(6.3e−01)		(2.0e−01)		(6.1e+01)	
f_6	4.8e+01	4.9e+01	+	4.9e+01	·	8.4e+02	+
	(6.1e+00)	(3.8e−01)		(7.6e+00)		(1.3e+02)	
f_7	7.9e+01	1.0e+02	+	8.3e+01	·	1.8e+02	+
	(1.5e+01)	(6.0e+00)		(1.7e+01)		(1.6e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.4e−02)	(3.8e−02)		(3.8e−02)		(3.9e−02)	
f_9	3.7e+01	7.2e+01	+	3.8e+01	·	7.2e+01	+
	(8.0e+00)	(1.2e+00)		(6.8e+00)		(1.3e+00)	
f_{10}	7.4e+00	8.1e+01	+	8.2e+00	·	2.2e+03	+
	(3.9e+00)	(1.6e+01)		(5.3e+00)		(2.8e+02)	
f_{11}	1.5e+02	3.6e+02	+	1.4e+02	·	5.8e+02	+
	(3.1e+01)	(1.7e+01)		(3.0e+01)		(3.4e+01)	
f_{12}	1.5e+02	4.0e+02	+	1.8e+02	·	6.5e+02	+
	(5.3e+01)	(1.8e+01)		(6.9e+01)		(3.9e+01)	
f_{13}	3.8e+02	4.0e+02	·	3.6e+02	·	6.5e+02	+
	(4.6e+01)	(1.2e+01)		(7.3e+01)		(3.1e+01)	
f_{14}	3.9e+03	1.2e+04	+	3.7e+03	·	1.3e+04	+
	(7.2e+02)	(4.5e+02)		(7.0e+02)		(3.6e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(4.7e+02)	(2.7e+02)		(3.9e+02)		(3.6e+02)	
f_{16}	3.3e+00	3.4e+00	·	3.3e+00	·	3.3e+00	·
	(3.6e−01)	(3.3e−01)		(3.0e−01)		(2.6e−01)	
f_{17}	2.5e+02	4.3e+02	+	2.5e+02	·	1.3e+03	+
	(3.9e+01)	(1.5e+01)		(3.6e+01)		(9.7e+01)	
f_{18}	4.8e+02	4.5e+02	−	4.8e+02	·	1.3e+03	+
	(2.8e+01)	(1.5e+01)		(2.5e+01)		(1.1e+02)	
f_{19}	1.5e+01	3.5e+01	+	1.4e+01	·	4.3e+03	+
	(2.7e+00)	(1.3e+00)		(3.1e+00)		(1.8e+03)	
f_{20}	2.3e+01	2.3e+01	·	2.3e+01	·	2.3e+01	+
	(3.5e−01)	(2.1e−01)		(3.4e−01)		(2.4e−01)	
f_{21}	6.7e+02	2.4e+02	·	6.5e+02	·	2.5e+03	+
	(4.5e+02)	(4.4e+00)		(4.2e+02)		(7.6e+02)	
f_{22}	4.0e+03	1.2e+04	+	4.0e+03	·	1.4e+04	+
	(8.6e+02)	(4.3e+02)		(6.1e+02)		(4.4e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(4.8e+02)	(3.8e+02)		(5.7e+02)		(3.9e+02)	
f_{24}	2.9e+02	3.2e+02	+	2.9e+02	·	3.9e+02	+
	(1.1e+01)	(1.1e+01)		(1.2e+01)		(7.3e+00)	
f_{25}	3.1e+02	4.1e+02	+	3.1e+02	·	4.1e+02	+
	(1.0e+01)	(1.1e+01)		(1.1e+01)		(9.4e+00)	
f_{26}	3.4e+02	2.8e+02	·	3.5e+02	·	4.2e+02	+
	(8.0e+01)	(1.1e+02)		(7.2e+01)		(1.1e+02)	
f_{27}	1.2e+03	2.0e+03	+	1.2e+03	·	2.2e+03	+
	(1.2e+02)	(7.7e+01)		(1.2e+02)		(6.0e+01)	
f_{28}	1.1e+03	4.2e+02	+	9.5e+02	·	1.8e+03	+
	(1.3e+03)	(1.7e+00)		(1.2e+03)		(9.1e+02)	
Summary (+/·/−)		19/8/1		0/28/0		23/5/0	

Table 242: Comparison of **DE/best/2/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/best/2/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	4.6e+04	4.0e+04	−	8.8e+03	−	5.1e+04	+
	(4.3e+03)	(3.4e+03)		(2.7e+03)		(4.8e+03)	
f_2	7.8e+08	7.3e+08	·	9.2e+07	−	8.3e+08	·
	(1.3e+08)	(1.0e+08)		(3.9e+07)		(1.1e+08)	
f_3	1.6e+11	1.7e+11	·	3.5e+10	−	1.7e+11	·
	(2.3e+10)	(2.1e+10)		(1.4e+10)		(2.2e+10)	
f_4	1.2e+05	1.3e+05	+	1.2e+05	·	1.2e+05	·
	(1.1e+04)	(8.1e+03)		(1.1e+04)		(1.0e+04)	
f_5	6.9e+03	5.4e+03	−	1.7e+03	−	6.7e+03	·
	(9.9e+02)	(6.0e+02)		(1.2e+03)		(8.7e+02)	
f_6	3.7e+03	3.2e+03	−	5.1e+02	−	4.1e+03	·
	(6.9e+02)	(3.5e+02)		(1.7e+02)		(6.4e+02)	
f_7	2.6e+02	2.7e+02	·	1.4e+02	−	2.7e+02	·
	(2.5e+01)	(1.7e+01)		(2.1e+01)		(2.1e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(2.8e−02)	(4.1e−02)		(3.6e−02)		(4.0e−02)	
f_9	7.3e+01	7.2e+01	·	6.3e+01	−	7.3e+01	·
	(1.0e+00)	(1.7e+00)		(6.7e+00)		(8.5e−01)	
f_{10}	6.3e+03	6.3e+03	·	1.5e+03	−	6.4e+03	·
	(6.5e+02)	(4.8e+02)		(4.8e+02)		(7.2e+02)	
f_{11}	1.0e+03	8.7e+02	−	3.2e+02	−	1.0e+03	·
	(5.4e+01)	(4.7e+01)		(5.5e+01)		(7.2e+01)	
f_{12}	1.0e+03	9.3e+02	−	5.0e+02	−	1.0e+03	·
	(5.5e+01)	(5.1e+01)		(7.1e+01)		(6.8e+01)	
f_{13}	9.9e+02	9.4e+02	−	4.9e+02	−	1.0e+03	·
	(6.5e+01)	(4.2e+01)		(4.5e+01)		(4.4e+01)	
f_{14}	1.3e+04	1.2e+04	−	4.0e+03	−	1.3e+04	·
	(6.1e+02)	(3.7e+02)		(6.1e+02)		(3.6e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	−	1.4e+04	·
	(2.8e+02)	(3.7e+02)		(4.9e+02)		(3.5e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.2e+00	·	3.3e+00	·
	(2.9e−01)	(3.1e−01)		(3.5e−01)		(2.7e−01)	
f_{17}	2.5e+03	2.2e+03	−	7.5e+02	−	2.6e+03	·
	(1.8e+02)	(1.2e+02)		(9.5e+01)		(1.7e+02)	
f_{18}	2.6e+03	2.2e+03	−	8.5e+02	−	2.6e+03	·
	(2.0e+02)	(1.1e+02)		(1.3e+02)		(1.3e+02)	
f_{19}	1.9e+05	1.4e+05	·	5.3e+03	−	2.1e+05	·
	(8.7e+04)	(3.7e+04)		(7.3e+03)		(9.7e+04)	
f_{20}	2.4e+01	2.4e+01	·	2.3e+01	−	2.4e+01	·
	(2.3e−01)	(2.0e−01)		(4.6e−01)		(2.6e−01)	
f_{21}	5.0e+03	3.9e+03	−	2.8e+03	−	5.2e+03	·
	(7.7e+02)	(2.3e+02)		(6.8e+02)		(8.1e+02)	
f_{22}	1.4e+04	1.3e+04	−	4.3e+03	−	1.4e+04	·
	(6.7e+02)	(4.7e+02)		(6.1e+02)		(4.3e+02)	
f_{23}	1.5e+04	1.5e+04	·	1.5e+04	·	1.5e+04	·
	(4.7e+02)	(4.4e+02)		(5.1e+02)		(3.5e+02)	
f_{24}	4.1e+02	4.1e+02	−	3.4e+02	−	4.2e+02	·
	(5.2e+00)	(4.9e+00)		(1.3e+01)		(5.9e+00)	
f_{25}	4.5e+02	4.5e+02	·	3.6e+02	−	4.6e+02	+
	(6.2e+00)	(5.4e+00)		(1.2e+01)		(6.7e+00)	
f_{26}	3.1e+02	3.7e+02	+	2.3e+02	−	3.1e+02	·
	(4.2e+01)	(2.9e+01)		(7.0e+01)		(3.3e+01)	
f_{27}	2.3e+03	2.3e+03	·	1.8e+03	−	2.3e+03	·
	(3.9e+01)	(3.5e+01)		(1.3e+02)		(4.4e+01)	
f_{28}	5.0e+03	4.6e+03	·	2.0e+03	−	5.3e+03	·
	(5.6e+02)	(2.7e+02)		(1.1e+03)		(5.3e+02)	
Summary (+/·/−)		2/14/12		0/4/24		2/26/0	

Table 243: Comparison of **DE/cur-to-rand/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-rand/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	7.3e+03	7.4e+03	·	2.5e+03	−	2.7e+04	+
	(8.2e+02)	(9.7e+02)		(1.5e+03)		(2.2e+03)	
f_2	4.7e+08	4.8e+08	·	2.2e+07	−	6.1e+08	+
	(5.7e+07)	(6.1e+07)		(8.8e+06)		(6.7e+07)	
f_3	1.0e+11	1.0e+11	·	1.2e+10	−	1.3e+11	+
	(7.8e+09)	(8.2e+09)		(5.0e+09)		(9.7e+09)	
f_4	1.2e+05	1.3e+05	·	1.0e+05	−	1.3e+05	·
	(1.0e+04)	(1.2e+04)		(1.3e+04)		(8.3e+03)	
f_5	1.1e+03	1.1e+03	·	2.9e+02	−	2.0e+03	+
	(1.2e+02)	(1.6e+02)		(3.0e+02)		(1.6e+02)	
f_6	5.6e+02	5.7e+02	·	2.1e+02	−	2.0e+03	+
	(6.7e+01)	(7.3e+01)		(8.2e+01)		(2.4e+02)	
f_7	2.0e+02	2.0e+02	·	9.9e+01	−	2.3e+02	+
	(9.7e+00)	(1.1e+01)		(2.2e+01)		(1.3e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.5e−02)	(3.5e−02)		(3.9e−02)		(3.0e−02)	
f_9	7.3e+01	7.2e+01	·	5.5e+01	−	7.3e+01	·
	(1.5e+00)	(1.1e+00)		(9.1e+00)		(1.6e+00)	
f_{10}	2.5e+03	2.4e+03	·	5.1e+02	−	4.6e+03	+
	(2.9e+02)	(4.0e+02)		(2.6e+02)		(3.3e+02)	
f_{11}	5.1e+02	5.1e+02	·	2.3e+02	−	7.2e+02	+
	(2.4e+01)	(2.6e+01)		(4.4e+01)		(3.1e+01)	
f_{12}	5.5e+02	5.7e+02	+	3.3e+02	−	7.9e+02	+
	(3.2e+01)	(2.3e+01)		(5.9e+01)		(2.9e+01)	
f_{13}	5.5e+02	5.6e+02	·	3.9e+02	−	7.9e+02	+
	(3.3e+01)	(3.0e+01)		(5.0e+01)		(3.5e+01)	
f_{14}	1.3e+04	1.2e+04	−	4.0e+03	−	1.3e+04	·
	(3.4e+02)	(4.5e+02)		(6.5e+02)		(3.2e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.8e+02)	(3.3e+02)		(3.6e+02)		(2.9e+02)	
f_{16}	3.4e+00	3.4e+00	·	3.5e+00	·	3.4e+00	·
	(2.6e−01)	(2.6e−01)		(2.6e−01)		(2.6e−01)	
f_{17}	7.8e+02	8.1e+02	+	4.7e+02	−	1.9e+03	+
	(5.3e+01)	(5.1e+01)		(9.7e+01)		(1.1e+02)	
f_{18}	8.0e+02	8.1e+02	·	5.5e+02	−	1.9e+03	+
	(5.5e+01)	(5.1e+01)		(8.8e+01)		(1.0e+02)	
f_{19}	9.0e+02	1.1e+03	·	9.5e+02	−	3.4e+04	+
	(3.1e+02)	(4.4e+02)		(1.9e+03)		(8.6e+03)	
f_{20}	2.4e+01	2.3e+01	·	2.3e+01	−	2.4e+01	+
	(2.0e−01)	(2.4e−01)		(4.7e−01)		(3.1e−01)	
f_{21}	1.6e+03	1.6e+03	·	1.5e+03	·	2.8e+03	+
	(9.5e+01)	(8.5e+01)		(6.4e+02)		(1.1e+02)	
f_{22}	1.4e+04	1.3e+04	−	4.3e+03	−	1.4e+04	·
	(3.1e+02)	(3.7e+02)		(6.5e+02)		(3.1e+02)	
f_{23}	1.5e+04	1.5e+04	·	1.4e+04	·	1.5e+04	·
	(3.7e+02)	(3.1e+02)		(5.3e+02)		(4.4e+02)	
f_{24}	3.9e+02	3.9e+02	·	3.1e+02	−	4.1e+02	+
	(5.7e+00)	(6.1e+00)		(1.2e+01)		(4.3e+00)	
f_{25}	4.5e+02	4.4e+02	·	3.4e+02	−	4.6e+02	+
	(4.8e+00)	(5.4e+00)		(1.2e+01)		(5.2e+00)	
f_{26}	3.4e+02	3.3e+02	·	3.0e+02	·	4.2e+02	+
	(5.2e+01)	(5.7e+01)		(1.1e+02)		(3.8e+01)	
f_{27}	2.2e+03	2.2e+03	·	1.5e+03	−	2.3e+03	+
	(4.5e+01)	(4.1e+01)		(1.4e+02)		(4.5e+01)	
f_{28}	1.5e+03	1.5e+03	·	1.1e+03	−	3.0e+03	+
	(1.0e+02)	(1.1e+02)		(1.1e+03)		(1.8e+02)	
Summary (+/·/−)		2/24/2		0/6/22		20/8/0	

Table 244: Comparison of **DE/cur-to-best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	3.2e−04	6.5e+00	+	5.3e−02	+	3.0e+04	+
	(1.8e−04)	(1.3e+00)		(4.0e−02)		(4.2e+03)	
f_2	9.0e+06	1.5e+08	+	1.4e+07	+	3.9e+08	+
	(2.6e+06)	(2.4e+07)		(4.8e+06)		(8.1e+07)	
f_3	1.6e+09	1.6e+10	+	4.0e+09	+	1.2e+11	+
	(9.6e+08)	(2.2e+09)		(2.0e+09)		(1.7e+10)	
f_4	6.4e+04	9.9e+04	+	7.8e+04	+	9.2e+04	+
	(1.2e+04)	(1.1e+04)		(1.1e+04)		(1.1e+04)	
f_5	2.0e−02	5.3e+00	+	5.9e−01	+	2.4e+03	+
	(1.1e−02)	(7.5e−01)		(2.7e−01)		(6.1e+02)	
f_6	4.7e+01	4.9e+01	+	5.0e+01	+	2.0e+03	+
	(8.3e+00)	(4.2e−01)		(1.1e+01)		(4.6e+02)	
f_7	6.9e+01	1.0e+02	+	7.7e+01	·	2.2e+02	+
	(2.0e+01)	(5.9e+00)		(1.7e+01)		(1.9e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(4.2e−02)	(3.1e−02)		(3.2e−02)		(3.4e−02)	
f_9	4.6e+01	7.3e+01	+	3.7e+01	·	7.3e+01	+
	(1.7e+01)	(1.7e+00)		(7.4e+00)		(1.5e+00)	
f_{10}	1.7e+00	9.0e+01	+	7.8e+00	+	3.9e+03	+
	(3.6e−01)	(1.8e+01)		(3.3e+00)		(5.7e+02)	
f_{11}	8.5e+01	3.6e+02	+	1.4e+02	+	7.7e+02	+
	(1.7e+01)	(1.7e+01)		(2.8e+01)		(5.9e+01)	
f_{12}	3.2e+02	4.0e+02	+	1.6e+02	−	8.1e+02	+
	(1.1e+02)	(1.6e+01)		(5.6e+01)		(5.6e+01)	
f_{13}	4.0e+02	4.0e+02	·	3.7e+02	·	8.0e+02	+
	(2.1e+01)	(1.7e+01)		(6.7e+01)		(7.2e+01)	
f_{14}	1.2e+04	1.2e+04	−	3.7e+03	−	1.3e+04	+
	(1.3e+03)	(3.6e+02)		(7.0e+02)		(3.1e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.8e+02)	(4.1e+02)		(4.8e+02)		(3.5e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.3e+00	·	3.3e+00	·
	(2.6e−01)	(2.8e−01)		(2.8e−01)		(3.2e−01)	
f_{17}	3.8e+02	4.3e+02	+	2.6e+02	−	2.1e+03	+
	(6.5e+01)	(1.7e+01)		(3.9e+01)		(2.1e+02)	
f_{18}	4.7e+02	4.5e+02	−	4.7e+02	·	2.1e+03	+
	(2.1e+01)	(1.5e+01)		(3.0e+01)		(1.9e+02)	
f_{19}	2.0e+01	3.5e+01	+	1.5e+01	·	6.4e+04	+
	(9.1e+00)	(1.5e+00)		(3.4e+00)		(4.0e+04)	
f_{20}	2.3e+01	2.3e+01	·	2.3e+01	·	2.3e+01	+
	(2.6e−01)	(2.0e−01)		(3.8e−01)		(3.5e−01)	
f_{21}	7.4e+02	2.4e+02	·	7.6e+02	+	3.8e+03	+
	(4.4e+02)	(4.6e+00)		(4.3e+02)		(9.3e+02)	
f_{22}	1.2e+04	1.2e+04	·	4.1e+03	−	1.4e+04	+
	(1.8e+03)	(3.7e+02)		(7.3e+02)		(4.4e+02)	
f_{23}	1.4e+04	1.4e+04	−	1.4e+04	−	1.5e+04	·
	(3.6e+02)	(3.5e+02)		(6.2e+02)		(4.4e+02)	
f_{24}	2.7e+02	3.2e+02	+	2.9e+02	+	3.9e+02	+
	(9.9e+00)	(1.0e+01)		(1.1e+01)		(7.3e+00)	
f_{25}	3.1e+02	4.1e+02	+	3.1e+02	·	4.2e+02	+
	(1.2e+01)	(9.7e+00)		(1.2e+01)		(1.0e+01)	
f_{26}	3.6e+02	2.4e+02	−	3.4e+02	·	4.4e+02	+
	(7.6e+01)	(8.0e+01)		(7.9e+01)		(9.6e+01)	
f_{27}	1.2e+03	2.0e+03	+	1.2e+03	·	2.2e+03	+
	(1.6e+02)	(9.0e+01)		(1.3e+02)		(5.1e+01)	
f_{28}	8.3e+02	4.2e+02	+	9.5e+02	+	3.5e+03	+
	(1.1e+03)	(1.7e+00)		(1.2e+03)		(1.2e+03)	
Summary (+/·/−)		17/7/4		11/12/5		24/4/0	

Table 245: Comparison of **DE/either-or/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_{\mathrm{r}} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/either-or/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	2.2e+04	1.3e+04	−	4.0e+03	−	3.2e+04	+
	(2.4e+03)	(1.7e+03)		(1.8e+03)		(2.4e+03)	
f_2	6.1e+08	5.6e+08	·	2.9e+07	−	6.4e+08	·
	(8.8e+07)	(7.7e+07)		(1.6e+07)		(9.1e+07)	
f_3	1.3e+11	1.2e+11	−	1.6e+10	−	1.4e+11	+
	(1.0e+10)	(9.4e+09)		(6.2e+09)		(1.6e+10)	
f_4	1.3e+05	1.3e+05	·	1.1e+05	−	1.3e+05	·
	(1.1e+04)	(8.9e+03)		(1.2e+04)		(9.6e+03)	
f_5	2.8e+03	1.9e+03	−	4.4e+02	−	2.8e+03	·
	(2.7e+02)	(2.0e+02)		(3.8e+02)		(2.1e+02)	
f_6	1.7e+03	9.5e+02	−	3.2e+02	−	2.4e+03	+
	(1.9e+02)	(1.3e+02)		(1.1e+02)		(2.6e+02)	
f_7	2.2e+02	2.2e+02	·	1.1e+02	−	2.4e+02	+
	(1.3e+01)	(9.1e+00)		(2.2e+01)		(1.5e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.2e−02)	(3.8e−02)		(3.7e−02)		(3.5e−02)	
f_9	7.3e+01	7.2e+01	·	5.6e+01	−	7.3e+01	·
	(1.4e+00)	(1.7e+00)		(8.4e+00)		(1.3e+00)	
f_{10}	4.6e+03	3.5e+03	−	7.7e+02	−	5.2e+03	+
	(4.1e+02)	(3.6e+02)		(3.7e+02)		(4.7e+02)	
f_{11}	6.9e+02	5.8e+02	−	2.6e+02	−	7.9e+02	+
	(3.7e+01)	(3.3e+01)		(3.8e+01)		(2.7e+01)	
f_{12}	7.6e+02	6.5e+02	−	3.6e+02	−	8.5e+02	+
	(3.8e+01)	(3.0e+01)		(6.3e+01)		(3.8e+01)	
f_{13}	7.7e+02	6.4e+02	−	4.1e+02	−	8.5e+02	+
	(3.9e+01)	(3.5e+01)		(5.8e+01)		(3.5e+01)	
f_{14}	1.3e+04	1.2e+04	−	4.0e+03	−	1.3e+04	·
	(3.1e+02)	(3.8e+02)		(5.6e+02)		(4.5e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.7e+02)	(3.0e+02)		(3.7e+02)		(3.3e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.2e+00	·	3.4e+00	·
	(2.7e−01)	(2.8e−01)		(3.4e−01)		(2.4e−01)	
f_{17}	1.5e+03	1.0e+03	−	5.6e+02	−	2.0e+03	+
	(9.4e+01)	(6.3e+01)		(1.1e+02)		(1.0e+02)	
f_{18}	1.5e+03	1.1e+03	−	6.1e+02	−	2.1e+03	+
	(8.5e+01)	(6.8e+01)		(9.5e+01)		(7.8e+01)	
f_{19}	2.3e+04	4.6e+03	−	1.2e+03	−	5.2e+04	+
	(6.1e+03)	(1.9e+03)		(1.7e+03)		(1.3e+04)	
f_{20}	2.4e+01	2.4e+01	·	2.3e+01	−	2.4e+01	+
	(2.1e−01)	(2.5e−01)		(4.7e−01)		(2.6e−01)	
f_{21}	2.7e+03	2.1e+03	−	1.9e+03	−	3.1e+03	+
	(1.3e+02)	(1.1e+02)		(5.7e+02)		(1.2e+02)	
f_{22}	1.4e+04	1.3e+04	−	4.6e+03	−	1.4e+04	·
	(2.9e+02)	(3.5e+02)		(6.4e+02)		(3.4e+02)	
f_{23}	1.5e+04	1.5e+04	·	1.5e+04	·	1.5e+04	·
	(3.1e+02)	(3.3e+02)		(4.1e+02)		(4.4e+02)	
f_{24}	4.0e+02	4.0e+02	−	3.3e+02	−	4.1e+02	+
	(5.4e+00)	(5.1e+00)		(1.3e+01)		(5.5e+00)	
f_{25}	4.5e+02	4.4e+02	·	3.4e+02	−	4.6e+02	+
	(5.6e+00)	(5.8e+00)		(1.3e+01)		(4.6e+00)	
f_{26}	3.4e+02	3.5e+02	·	2.6e+02	−	4.1e+02	+
	(4.1e+01)	(5.4e+01)		(9.9e+01)		(3.6e+01)	
f_{27}	2.3e+03	2.2e+03	·	1.5e+03	−	2.3e+03	+
	(3.7e+01)	(5.5e+01)		(1.4e+02)		(5.2e+01)	
f_{28}	2.9e+03	2.1e+03	−	1.5e+03	−	3.5e+03	+
	(2.3e+02)	(1.3e+02)		(1.3e+03)		(1.9e+02)	
Summary (+/·/−)		0/12/16		0/4/24		18/10/0	

Table 246: Comparison of **DE/cur-to-$p$best/1/bin** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with $F = \mathbf{0.9}$ and $C_\mathrm{r} = \mathbf{0.9}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur-to-$p$best/1/bin	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	5.1e+00	2.9e+03	+	8.2e+02	+	5.7e+04	+
	(2.0e+00)	(4.6e+02)		(9.6e+02)		(6.6e+03)	
f_2	7.8e+07	3.7e+08	+	1.6e+07	−	7.5e+08	+
	(2.3e+07)	(4.9e+07)		(6.2e+06)		(1.3e+08)	
f_3	7.2e+09	7.5e+10	+	9.4e+09	·	1.8e+11	+
	(2.1e+09)	(6.8e+09)		(4.8e+09)		(3.7e+10)	
f_4	9.2e+04	1.2e+05	+	9.7e+04	·	1.2e+05	+
	(9.7e+03)	(1.1e+04)		(1.0e+04)		(1.0e+04)	
f_5	7.2e+00	4.4e+02	+	9.3e+01	+	8.1e+03	+
	(2.0e+00)	(5.7e+01)		(1.5e+02)		(1.6e+03)	
f_6	4.8e+01	3.0e+02	+	1.2e+02	+	4.6e+03	+
	(1.0e+00)	(3.2e+01)		(5.3e+01)		(7.7e+02)	
f_7	8.5e+01	1.8e+02	+	8.9e+01	·	2.7e+02	+
	(1.0e+01)	(6.8e+00)		(1.5e+01)		(3.9e+01)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	·	2.1e+01	·
	(3.8e−02)	(3.5e−02)		(3.6e−02)		(2.9e−02)	
f_9	7.2e+01	7.3e+01	·	4.8e+01	−	7.3e+01	·
	(1.7e+00)	(1.3e+00)		(9.5e+00)		(1.4e+00)	
f_{10}	3.9e+01	1.4e+03	+	2.6e+02	+	6.9e+03	+
	(1.2e+01)	(1.7e+02)		(1.9e+02)		(9.3e+02)	
f_{11}	2.7e+02	4.5e+02	+	1.8e+02	−	1.1e+03	+
	(4.2e+01)	(2.1e+01)		(3.8e+01)		(9.2e+01)	
f_{12}	4.0e+02	4.9e+02	+	2.4e+02	−	1.0e+03	+
	(2.3e+01)	(2.2e+01)		(5.2e+01)		(7.3e+01)	
f_{13}	4.2e+02	4.9e+02	+	3.7e+02	−	1.1e+03	+
	(1.6e+01)	(1.9e+01)		(5.2e+01)		(8.2e+01)	
f_{14}	1.3e+04	1.2e+04	−	3.6e+03	−	1.3e+04	·
	(3.3e+02)	(4.5e+02)		(5.5e+02)		(4.1e+02)	
f_{15}	1.4e+04	1.4e+04	·	1.4e+04	·	1.4e+04	·
	(3.2e+02)	(3.5e+02)		(5.6e+02)		(3.5e+02)	
f_{16}	3.3e+00	3.3e+00	·	3.3e+00	·	3.3e+00	·
	(3.0e−01)	(3.2e−01)		(3.0e−01)		(3.3e−01)	
f_{17}	4.5e+02	6.2e+02	+	3.8e+02	−	2.8e+03	+
	(2.0e+01)	(3.0e+01)		(8.5e+01)		(2.2e+02)	
f_{18}	4.7e+02	6.3e+02	+	4.7e+02	·	2.8e+03	+
	(2.1e+01)	(2.5e+01)		(9.5e+01)		(2.6e+02)	
f_{19}	3.4e+01	1.6e+02	+	1.1e+02	·	6.6e+05	+
	(2.4e+00)	(4.8e+01)		(2.9e+02)		(4.4e+05)	
f_{20}	2.3e+01	2.3e+01	+	2.3e+01	·	2.4e+01	+
	(2.4e−01)	(2.4e−01)		(4.9e−01)		(3.6e−01)	
f_{21}	5.3e+02	1.1e+03	+	1.1e+03	+	5.9e+03	+
	(4.1e+02)	(5.9e+01)		(4.5e+02)		(7.7e+02)	
f_{22}	1.4e+04	1.3e+04	−	3.8e+03	−	1.4e+04	·
	(3.4e+02)	(5.6e+02)		(6.5e+02)		(3.6e+02)	
f_{23}	1.4e+04	1.4e+04	·	1.4e+04	·	1.5e+04	+
	(3.1e+02)	(3.3e+02)		(5.7e+02)		(4.2e+02)	
f_{24}	2.9e+02	3.8e+02	+	3.1e+02	·	4.1e+02	+
	(1.6e+01)	(6.9e+00)		(1.3e+01)		(7.9e+00)	
f_{25}	4.1e+02	4.4e+02	+	3.3e+02	−	4.5e+02	+
	(2.1e+01)	(6.2e+00)		(1.2e+01)		(8.6e+00)	
f_{26}	2.8e+02	3.0e+02	+	3.0e+02	·	3.5e+02	+
	(1.1e+02)	(6.8e+01)		(1.1e+02)		(7.4e+01)	
f_{27}	1.8e+03	2.2e+03	+	1.4e+03	−	2.3e+03	+
	(2.6e+02)	(3.9e+01)		(1.1e+02)		(4.3e+01)	
f_{28}	5.4e+02	9.5e+02	+	9.2e+02	+	6.2e+03	+
	(6.2e+02)	(5.1e+01)		(1.0e+03)		(8.9e+02)	
Summary (+/·/−)		21/5/2		6/12/10		22/6/0	

Table 247: Comparison of **DE/cur/1** with three modelling variants using equivalent scaling factors for 28 function of the **10**-dimensional CEC'13 benchmark with default value of F (randomized) and $C_\mathrm{r} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur/1	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	1.8e−04	3.7e+03	+	6.5e+03	+	2.1e+03	+
	(1.2e−04)	(1.1e+03)		(1.7e+03)		(4.7e+02)	
f_2	2.2e+00	2.1e+07	+	4.0e+07	+	9.5e+06	+
	(2.6e+00)	(7.6e+06)		(1.5e+07)		(3.2e+06)	
f_3	1.3e+07	7.0e+09	+	1.9e+10	+	3.9e+09	+
	(5.9e+06)	(2.4e+09)		(8.2e+09)		(9.3e+08)	
f_4	3.8e−03	2.1e+04	+	3.9e+04	+	1.3e+04	+
	(2.6e−03)	(5.1e+03)		(1.4e+04)		(3.7e+03)	
f_5	3.8e−03	4.2e+02	+	1.6e+03	+	1.8e+02	+
	(2.2e−03)	(1.9e+02)		(7.5e+02)		(4.3e+01)	
f_6	1.9e−01	2.4e+02	+	4.1e+02	+	1.4e+02	+
	(1.4e−01)	(5.9e+01)		(1.2e+02)		(3.0e+01)	
f_7	1.6e+01	1.2e+02	+	1.9e+02	+	9.1e+01	+
	(2.7e+00)	(2.6e+01)		(5.0e+01)		(1.7e+01)	
f_8	2.0e+01	2.0e+01	+	2.1e+01	+	2.0e+01	·
	(6.0e−02)	(8.9e−02)		(1.2e−01)		(6.3e−02)	
f_9	6.5e+00	9.9e+00	+	1.1e+01	+	8.7e+00	+
	(6.2e−01)	(6.5e−01)		(7.1e−01)		(7.3e−01)	
f_{10}	4.4e−01	4.1e+02	+	7.6e+02	+	2.4e+02	+
	(8.3e−02)	(1.0e+02)		(2.2e+02)		(6.4e+01)	
f_{11}	3.2e+01	1.1e+02	+	1.4e+02	+	8.3e+01	+
	(5.4e+00)	(1.5e+01)		(2.4e+01)		(9.4e+00)	
f_{12}	3.3e+01	1.2e+02	+	1.4e+02	+	9.1e+01	+
	(5.3e+00)	(1.5e+01)		(2.5e+01)		(9.4e+00)	
f_{13}	3.4e+01	1.2e+02	+	1.5e+02	+	9.1e+01	+
	(5.1e+00)	(1.2e+01)		(2.3e+01)		(1.1e+01)	
f_{14}	1.4e+03	1.7e+03	+	2.0e+03	+	1.5e+03	+
	(1.5e+02)	(1.9e+02)		(2.7e+02)		(1.6e+02)	
f_{15}	1.4e+03	1.8e+03	+	2.0e+03	+	1.5e+03	+
	(1.6e+02)	(1.6e+02)		(1.7e+02)		(1.5e+02)	
f_{16}	1.2e+00	1.5e+00	+	2.3e+00	+	1.1e+00	·
	(1.9e−01)	(2.9e−01)		(4.0e−01)		(1.6e−01)	
f_{17}	4.9e+01	2.0e+02	+	2.6e+02	+	1.6e+02	+
	(5.6e+00)	(3.0e+01)		(3.8e+01)		(2.2e+01)	
f_{18}	5.1e+01	2.0e+02	+	2.6e+02	+	1.6e+02	+
	(4.4e+00)	(2.8e+01)		(4.1e+01)		(2.0e+01)	
f_{19}	2.8e+00	6.7e+02	+	5.2e+03	+	8.8e+01	+
	(4.0e−01)	(5.6e+02)		(5.0e+03)		(5.2e+01)	
f_{20}	3.3e+00	4.3e+00	+	4.7e+00	+	4.1e+00	+
	(2.2e−01)	(1.9e−01)		(1.9e−01)		(1.3e−01)	
f_{21}	1.3e+02	6.5e+02	+	7.7e+02	+	5.5e+02	+
	(4.6e+01)	(5.9e+01)		(8.9e+01)		(5.5e+01)	
f_{22}	1.6e+03	2.0e+03	+	2.3e+03	+	1.8e+03	+
	(1.5e+02)	(1.7e+02)		(2.0e+02)		(1.5e+02)	
f_{23}	1.6e+03	2.1e+03	+	2.3e+03	+	1.8e+03	+
	(1.8e+02)	(1.7e+02)		(2.3e+02)		(1.4e+02)	
f_{24}	1.7e+02	2.3e+02	+	2.4e+02	+	2.2e+02	+
	(1.4e+01)	(6.7e+00)		(7.5e+00)		(1.3e+01)	
f_{25}	1.9e+02	2.3e+02	+	2.4e+02	+	2.1e+02	·
	(2.4e+01)	(6.9e+00)		(3.6e+00)		(1.2e+01)	
f_{26}	1.4e+02	2.1e+02	+	2.3e+02	+	2.0e+02	+
	(6.1e+00)	(3.9e+00)		(1.5e+01)		(1.1e+01)	
f_{27}	4.2e+02	6.9e+02	+	7.7e+02	+	6.5e+02	+
	(1.4e+01)	(3.8e+01)		(4.5e+01)		(2.7e+01)	
f_{28}	1.1e+02	9.7e+02	+	1.2e+03	+	7.2e+02	+
	(4.0e+01)	(1.7e+02)		(1.3e+02)		(1.0e+02)	
Summary (+/·/−)		28/0/0		28/0/0		25/3/0	

Table 248: Comparison of **DE/cur/1** with three modelling variants using equivalent scaling factors for 28 function of the **30**-dimensional CEC'13 benchmark with default value of F (randomized) and $C_\mathrm{r} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur/1	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	4.7e+02	4.3e+04	+	5.2e+04	+	4.1e+04	+
	(1.3e+02)	(4.3e+03)		(8.8e+03)		(5.0e+03)	
f_2	7.6e+06	4.6e+08	+	7.1e+08	+	4.2e+08	+
	(1.7e+06)	(1.0e+08)		(1.9e+08)		(8.5e+07)	
f_3	1.4e+10	2.2e+13	+	2.7e+15	+	1.4e+13	+
	(2.7e+09)	(3.2e+13)		(5.7e+15)		(1.8e+13)	
f_4	5.6e+03	8.4e+04	+	1.1e+05	+	7.8e+04	+
	(1.2e+03)	(1.0e+04)		(1.5e+04)		(8.9e+03)	
f_5	1.0e+02	8.0e+03	+	1.6e+04	+	6.9e+03	+
	(1.8e+01)	(1.8e+03)		(3.6e+03)		(1.3e+03)	
f_6	2.0e+02	4.9e+03	+	7.5e+03	+	4.8e+03	+
	(1.6e+01)	(1.1e+03)		(1.9e+03)		(1.0e+03)	
f_7	1.2e+02	3.5e+03	+	3.1e+04	+	2.9e+03	+
	(1.3e+01)	(3.3e+03)		(3.9e+04)		(2.8e+03)	
f_8	2.1e+01	2.1e+01	+	2.1e+01	+	2.1e+01	·
	(5.7e−02)	(5.6e−02)		(6.7e−02)		(5.1e−02)	
f_9	3.6e+01	4.0e+01	+	4.3e+01	+	3.9e+01	+
	(1.3e+00)	(1.0e+00)		(1.3e+00)		(1.2e+00)	
f_{10}	6.7e+01	5.2e+03	+	6.8e+03	+	5.1e+03	+
	(1.3e+01)	(6.9e+02)		(8.3e+02)		(6.3e+02)	
f_{11}	2.5e+02	6.8e+02	+	8.4e+02	+	6.6e+02	+
	(1.4e+01)	(6.3e+01)		(1.1e+02)		(5.0e+01)	
f_{12}	2.5e+02	7.2e+02	+	8.4e+02	+	7.0e+02	+
	(1.8e+01)	(8.3e+01)		(1.0e+02)		(6.1e+01)	
f_{13}	2.6e+02	7.2e+02	+	8.7e+02	+	7.1e+02	+
	(1.6e+01)	(6.5e+01)		(9.3e+01)		(5.3e+01)	
f_{14}	7.3e+03	7.4e+03	·	8.1e+03	+	7.3e+03	·
	(2.6e+02)	(4.0e+02)		(4.1e+02)		(3.5e+02)	
f_{15}	7.3e+03	7.7e+03	+	8.3e+03	+	7.5e+03	·
	(3.0e+02)	(3.0e+02)		(2.9e+02)		(2.7e+02)	
f_{16}	2.5e+00	2.6e+00	·	3.4e+00	+	2.5e+00	·
	(2.4e−01)	(2.8e−01)		(3.4e−01)		(2.0e−01)	
f_{17}	3.2e+02	1.5e+03	+	1.8e+03	+	1.5e+03	+
	(2.0e+01)	(1.4e+02)		(1.6e+02)		(9.7e+01)	
f_{18}	3.2e+02	1.5e+03	+	1.8e+03	+	1.5e+03	+
	(2.0e+01)	(1.5e+02)		(2.0e+02)		(9.0e+01)	
f_{19}	3.3e+01	5.0e+05	+	1.3e+06	+	3.6e+05	+
	(4.0e+00)	(2.3e+05)		(6.1e+05)		(1.2e+05)	
f_{20}	1.3e+01	1.5e+01	+	1.5e+01	+	1.5e+01	+
	(2.5e−01)	(3.2e−02)		(3.7e−05)		(6.7e−02)	
f_{21}	6.7e+02	3.6e+03	+	4.0e+03	+	3.5e+03	+
	(5.1e+01)	(2.3e+02)		(3.7e+02)		(2.3e+02)	
f_{22}	7.7e+03	8.2e+03	+	8.8e+03	+	8.0e+03	+
	(3.0e+02)	(3.7e+02)		(4.5e+02)		(2.6e+02)	
f_{23}	7.6e+03	8.3e+03	+	8.9e+03	+	8.1e+03	+
	(3.1e+02)	(2.7e+02)		(4.3e+02)		(2.8e+02)	
f_{24}	3.0e+02	3.5e+02	+	3.6e+02	+	3.5e+02	+
	(5.5e+00)	(7.1e+00)		(1.8e+01)		(6.1e+00)	
f_{25}	3.3e+02	3.6e+02	+	3.7e+02	+	3.6e+02	+
	(4.3e+00)	(6.1e+00)		(1.3e+01)		(6.3e+00)	
f_{26}	2.0e+02	2.6e+02	+	2.9e+02	+	2.5e+02	+
	(3.2e−01)	(1.3e+01)		(2.3e+01)		(1.2e+01)	
f_{27}	1.3e+03	1.5e+03	+	1.6e+03	+	1.5e+03	+
	(3.4e+01)	(4.2e+01)		(5.4e+01)		(3.2e+01)	
f_{28}	1.4e+03	5.2e+03	+	5.9e+03	+	5.1e+03	+
	(7.4e+01)	(3.9e+02)		(6.1e+02)		(2.7e+02)	
Summary (+/·/−)		26/2/0		28/0/0		24/4/0	

Table 249: Comparison of **DE/cur/1** with three modelling variants using equivalent scaling factors for 28 function of the **50**-dimensional CEC'13 benchmark with default value of F (randomized) and $C_\mathrm{r} = \mathbf{1}$; reported are mean errors, their standard deviations (in brackets) and the outcome of a paired test sign

Fun.	Modelled DE variant	Modelling DE variants					
	DE/cur/1	DE/rand/1/bin		DE/best/1/bin		DE/X/∞/bin	
f_1	6.2e+03	9.5e+04	+	1.1e+05	+	9.4e+04	+
	(1.3e+03)	(6.3e+03)		(1.1e+04)		(5.5e+03)	
f_2	6.9e+07	1.4e+09	+	1.9e+09	+	1.4e+09	+
	(1.2e+07)	(2.0e+08)		(3.5e+08)		(2.4e+08)	
f_3	7.6e+10	2.1e+13	+	5.2e+14	+	1.6e+13	+
	(8.1e+09)	(3.1e+13)		(6.6e+14)		(1.6e+13)	
f_4	3.8e+04	1.5e+05	+	1.8e+05	+	1.4e+05	+
	(4.6e+03)	(1.1e+04)		(1.6e+04)		(1.1e+04)	
f_5	9.3e+02	2.2e+04	+	3.2e+04	+	2.1e+04	+
	(1.1e+02)	(2.8e+03)		(6.5e+03)		(2.8e+03)	
f_6	6.6e+02	1.0e+04	+	1.3e+04	+	1.0e+04	+
	(8.3e+01)	(1.3e+03)		(2.4e+03)		(1.4e+03)	
f_7	1.7e+02	2.6e+03	+	1.3e+04	+	3.0e+03	+
	(1.0e+01)	(1.6e+03)		(1.1e+04)		(1.8e+03)	
f_8	2.1e+01	2.1e+01	·	2.1e+01	+	2.1e+01	·
	(3.3e−02)	(3.8e−02)		(3.9e−02)		(2.9e−02)	
f_9	6.8e+01	7.3e+01	+	7.7e+01	+	7.3e+01	+
	(1.4e+00)	(1.4e+00)		(1.6e+00)		(1.3e+00)	
f_{10}	7.6e+02	1.2e+04	+	1.4e+04	+	1.1e+04	+
	(1.2e+02)	(1.0e+03)		(1.9e+03)		(8.8e+02)	
f_{11}	5.7e+02	1.5e+03	+	1.6e+03	+	1.5e+03	+
	(3.1e+01)	(1.1e+02)		(1.9e+02)		(9.1e+01)	
f_{12}	5.8e+02	1.4e+03	+	1.5e+03	+	1.5e+03	+
	(2.6e+01)	(1.0e+02)		(1.8e+02)		(7.1e+01)	
f_{13}	5.8e+02	1.5e+03	+	1.6e+03	+	1.5e+03	+
	(2.8e+01)	(8.6e+01)		(1.9e+02)		(6.9e+01)	
f_{14}	1.4e+04	1.4e+04	·	1.4e+04	+	1.4e+04	·
	(2.9e+02)	(4.1e+02)		(7.4e+02)		(3.3e+02)	
f_{15}	1.4e+04	1.4e+04	+	1.5e+04	+	1.4e+04	+
	(4.0e+02)	(3.3e+02)		(3.7e+02)		(3.2e+02)	
f_{16}	3.4e+00	3.4e+00	·	4.2e+00	+	3.4e+00	·
	(2.9e−01)	(2.8e−01)		(3.9e−01)		(2.8e−01)	
f_{17}	7.6e+02	3.4e+03	+	3.5e+03	+	3.3e+03	+
	(3.6e+01)	(2.1e+02)		(3.6e+02)		(1.6e+02)	
f_{18}	7.5e+02	3.3e+03	+	3.7e+03	+	3.4e+03	+
	(4.2e+01)	(2.1e+02)		(3.4e+02)		(1.5e+02)	
f_{19}	1.0e+03	2.5e+06	+	4.7e+06	+	2.3e+06	+
	(5.1e+02)	(7.1e+05)		(1.6e+06)		(6.4e+05)	
f_{20}	2.3e+01	2.5e+01	+	2.5e+01	+	2.5e+01	+
	(2.1e−01)	(4.2e−02)		(2.4e−02)		(7.2e−02)	
f_{21}	1.5e+03	7.8e+03	+	8.2e+03	+	7.6e+03	+
	(1.1e+02)	(3.3e+02)		(7.5e+02)		(3.6e+02)	
f_{22}	1.4e+04	1.5e+04	+	1.6e+04	+	1.5e+04	+
	(4.1e+02)	(6.1e+02)		(7.4e+02)		(3.5e+02)	
f_{23}	1.5e+04	1.6e+04	+	1.6e+04	+	1.5e+04	+
	(3.8e+02)	(3.4e+02)		(5.0e+02)		(3.6e+02)	
f_{24}	4.2e+02	4.7e+02	+	5.0e+02	+	4.9e+02	+
	(7.7e+00)	(2.0e+01)		(4.2e+01)		(1.6e+01)	
f_{25}	4.7e+02	5.1e+02	+	5.2e+02	+	5.3e+02	+
	(7.2e+00)	(1.8e+01)		(3.2e+01)		(1.1e+01)	
f_{26}	2.3e+02	3.8e+02	+	4.7e+02	+	3.7e+02	+
	(5.8e+00)	(3.1e+01)		(4.1e+01)		(2.9e+01)	
f_{27}	2.2e+03	2.5e+03	+	2.6e+03	+	2.5e+03	+
	(5.5e+01)	(5.9e+01)		(1.1e+02)		(5.0e+01)	
f_{28}	1.3e+03	9.7e+03	+	1.1e+04	+	9.7e+03	+
	(1.2e+02)	(5.5e+02)		(8.4e+02)		(5.1e+02)	
Summary (+/·/−)		25/3/0		28/0/0		25/3/0	